**Sudan University of Science and Technology**

**College of Graduate Studies**

**College of Languages**

# The Cruciality of Understanding and Mastering English Phonotactics of Syllable Initial and Final Consonant Clusters for Sudanese EFL Undergraduates

**الأهمية القصوى لفهم وإتقان نظام التتابع الصوتي في مقطع اللغة الإنجليزية المكون من مجموعة أصوات ساكنة في مستهل الكلمة ونهايتها لطلاب اللغة الإنجليزية السودانيين على مستوى الجامعات**

**A Thesis Submitted in Fulfillment of the Requirements for the Degree of Ph.D. in English Language (Applied Linguistics)**

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# Dedication

This thesis is dedicated:

To the soul of my deceased cousin A'awadiya Abdu-Alsadig and ALL the martyrs of the December revolution whose sacrifices give us a hope of a better future 'May their souls RIP'! And to my beloved aunt, Fanta, for offering me a shelter and household at all levels of my higher education and particularly during the completion of this thesis. To my father whose repeated phrase "you've to finish and leave it behind" triggers and encourages me to have this work done. To my beloved grandparents, Genet and the late Mariam, whose upbringing teaches me the value and taste of education.

# Acknowledgements

# Abstract

This study explores the cruciality of understanding and mastering English phonotactics and phonological errors in pronouncing English words involving ICCs and FCCs and its causes for Sudanese EFL undergraduates. It is also carried out to investigate the effectiveness of methods, materials and activities used for teaching English phonotactics. The researcher adopts a mixed method to analyse the data obtained by four instruments. The first one is a test composed of 50 pseudo-words involving the three elements of ICCs and FCCs; two, three and two, three, four CCs respectively. The second tool is a word-list reading test consisting of 24 words with the same previously mentioned elements of CCs. The third one is a semi-structured interview with 6 open-ended and extended questions. The last instrument is an observation with 16 checklist items purposefully designed by taking into consideration the different variables and theoretical framework of this study. The participants of this study are EFL university instructors and students. The first instrument is undertaken by 100 fourth year students from Al-Neelain University, SUST, Almughtaribeen University and Nahda College. 60 students from the same previously mentioned institutions undertake the second instrument. To avoid subjectivity and to analyse this test, the researcher utilises a computer software program 'Praat' to analyse the participants' speech. The researcher attends an hour-and-a-half lecture on phonotactics and CCs at Al-Neelain University and Nahda College with third year students to conduct the observation. The last group of participants is eight experienced EFL instructors on teaching phonology who participate in the interview from Al-Neelain University, International University of Africa, Almughtaribeen University and Nahda College. The findings reveal that Sudanese EFL undergraduates face magnitude difficulties in understanding and mastering English phonotactics of words involving ICCs and

FCCs and mispronounce most of them particularly three ICCs and four FCCs. It also shows that the major causes of these mispronunciations are unrequired pause between consonant segments in one syllable, insertion of an intrusive vowel to break the string of CCs particularly in ICCs more than FCCs, deletion of consonant segments in FCCs, consonant replacement and consonant-vowel position conversion. Moreover, the findings demonstrate that teaching methods, materials and activities used in teaching the sound system of English language are not effective for improving pronunciation skills and more particularly CCs of the students and lack many principles of teaching pronunciation. Additionally, the results reveal that the participants' failure to correctly pronounce English words is attributed to the linguistics differences between the phonotactic system of their MT language and the TL. Finally, the researcher modestly recommends that EFL students likewise instructors should be aware of the differences between their TL and MT particularly in terms of CCs. It is also highly recommended that EFL instructors should provide students with authentic audiovisual materials.

# المستخلص

تتقصى هذه الدارسة المصاعب التي تواجه الطالبات والطلاب السودانيين الذين يدرسون اللغة الإنجليزية كلغة أجنبية على المستوى الجامعي في فهم واتقان ضوابط نظام التتابع الصوتي في اللغة الإنجليزية والأخطاء التي يرتكبونها عند نطقهم لكلماتها التي تتكون من مجموعة أصوات ساكنة في بداية ونهاية الكلمة. كما تتحقق من فاعلية طرق التدريس والمواد والوسائل والتدريبات المستخدمة في تدريس ضوابط نظام التتابع الصوتي في اللغة الإنجليزية، ولتحقيق هذه الأهداف تبنى الباحث المنهج التكاملي لتحليل البيانات التي تحصل عليها بأربع أدوات لجمع البيانات. أول هذه الأدوات هو اختبار مكون من خمسين كلمة مستعارة تتضمن المكونين والثلاثة مكونات لمجموعة الأصوات الساكنة في بداية الكلمة ونهايتها. الأداة الثانية هي عبارة عن اختبار شفهي لقراءة أربع وعشرين كلمة متضمنة المكونات التي سبق ذكرها. أما الأداة الثالثة فهي عبارة عن مقابلة مكونة من ستة أسئلة. الأداة الرابعة والأخيرة هي ملاحظة مكونة من ستة عشر قائمة رصد مصممة وفقاً للمتغيرات والإطار النظري للدراسة. تتكون عينة هذه الدرسة من أساتذة وطلاب جامعيين وقد شارك مائة طالب وطالبة في المستوى الرابع من جامعة النيلين وجامعة السودان للعلوم والتكنولوجيا وجامعة المغتربين وكلية النهضة في الأداة الأولى، كما شارك ستون طالباً وطالبةً من نفس المؤسسات التي سبق ذكرها في الأداة الثانية. ولتجنب التقويم الذاتي وتحليل هذا الاختبار استخدم الباحث برنامج محوسب 'Praat' للتحليل البيانات. حيث حضر الباحث محاضرتين لمدة ساعة ونصف في ضوابط نظام التتابع الصوتي والتقاء السواكن في اللغة الإنجليزية في كل من جامعة النيلين وكلية النهضة مع طالبات وطلاب المستوى الثالث لإجراء الملاحظة. المجموعة الأخيرة من المشاركين في هذه الدراسة هم ثمانية أساتذة ذوو خبرة في تدريس الفونولوجيا من جامعة النيلين وجامعة أفريقيا العالمية وجامعة المغتربين وكلية النهضة. أظهرت النتائج إن الطالبات والطلاب السودانيين يواجهون قدراً كبيراً من المعضلات في فهم واتقان ضوابط نظام التتابع الصوتي للكلمات التي تحتوي مجموعة أصوات ساكنة في بداية الكلمة ونهايتها ويخطئون في نطق معظمها خاصة التي تتكون من ثلاثة أصوات في بداية الكلمة وأربعة في نهايتها. كما بينت النتائج أيضاً أن المسببات الرئيسة للنطق الخاطئ تتمثل في الوقف غير المقتضى بين الأصوات الساكنة في المقطع الواحد وإدخال الأصوات المتحركة لقطع تسلسل التقاء السواكن في بداية الكلمة أكثر من نهايتها وحذف بعض السواكن في نهاية الكلمة واستعاضة السواكن ببعضها البعض وتحويل موقع الساكن بالمتحرك. بالإضافة الى ذلك أظهرت النتائج أن طرق التدريس والمواد والوسائل والتدريبات المستخدمة في تدريس ضوابط نظام التتابع الصوتي في اللغة الإنجليزية غير فعالة لتطوير مهارات النطق للطالبات والطلاب خاصة فيما يتعلق بنطق التقاء

السواكن وتفتقد للكثير من أساسيات تدريس مهارات النطق. علاوةً على ذلك بينت النتائج أن الاختلاف اللغوي بين ضوابط نظام التتابع الصوتي في لغتهم الأم واللغة الهدف هو السبب الرئيس للنطق الخاطئ. وعليه فإن الباحث يوصي الطالبات والطلاب والأساتذة بأن يطلعوا على الاختلافات بين لغتهم الأم واللغة الهدف خاصةً بما يتعلق بالتقاء السواكن، كما يوصي الأساتذة بتوفير المواد السمعية والبصرية الموثوقة للطالبات والطلاب.

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| | |
|---|---|
| $C_1$ | first consonant |
| $C_2$ | second consonant |
| $C_3$ | third consonant |
| $C_4$ | forth consonant |
| CCs | consonant clusters |
| FCCs | final consonant clusters |
| FiFCC | first final consonant cluster |
| SFCC | second final consonant cluster |
| TFCC | third final consonant cluster |
| FoFCC | forth final consonant cluster |
| ICCs | initial consonant clusters |
| SICC | second initial consonant cluster |

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1. Appendix A 'Test 1'
2. Appendix B 'Test 2'
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# List of Publications

1. The Cruciality of Mastering English Phonotactics of Final Consonant Clusters for Sudanese EFL Undergraduates

2. Phonotactic Cruciality of English Initial and Final Consonant Clusters' Pronunciation on Sudanese EFL Undergraduates

# CHAPTER ONE

## Introduction

### 1.0 Background of the Study

One of the fundamental purposes of learning a foreign language is to acquire a native-like pronunciation or fluency. Many Sudanese undergraduates of English as a Foreign Language (henceforth, EFL) encounter difficulties in learning English and these difficulties are based on the linguistic differences between English and Arabic which is their mother tongue (henceforth, MT) language such as semantic, syntactic, morphological and phonological differences.

The current study is concerned with the phonological aspect of English and Arabic because phonology is considered as the vein of pronunciation beside phonetics. Yule (2014, p. 40) defines phonology as "the description of the systems and patterns of speech sounds in a language". Thus, this study in particular is concerned with the nature of phonotactic system of English and Arabic syllable structure of words involving consonant clusters (henceforth, CCs) and its performance by Sudanese EFL undergraduates. Phonotactics in phonology is defined as "the arrangements of the distinctive sound unit or phoneme" (Richards and Schmidt 2010, p. 444). English syllable is composed of two elements; the onset (at the beginning of the word) with one, two or three consonants and the rhyme which is divided into peak (nucleus) usually vowel and coda (at the end of the word) with one, two, three or four consonants (in small cases). Hence the syllable must consist of a peak but it may have no onset (zero onset) or coda (zero coda) and may be both as shown in the following figure (Roach 2009, pp. 56-60):

```
                              Syllable
                         ╱              ╲
                        ╱                ╲
                       ╱              Rhyme
                      ╱             ╱        ╲
                     ╱            ╱            ╲
                    ╱           ╱                ╲
              Onset        Peak (nucleus)        Coda
                ⇓                ⇓                 ⇓
      1, 2 or 3 consonants    1 vowel    1, 2, 3 or 4 consonants
```
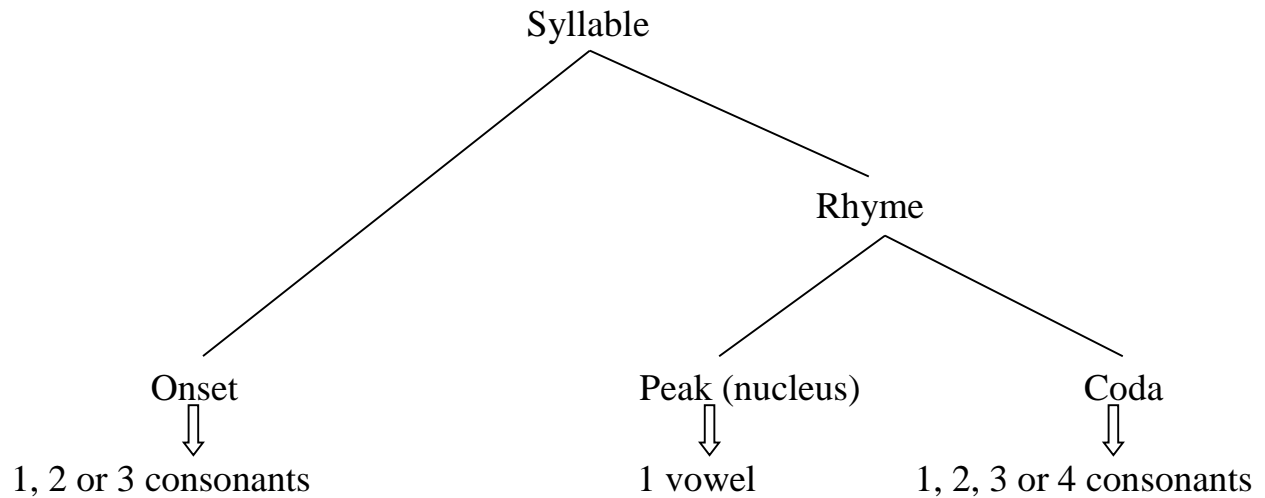
The nature of syllable structure of words involving CCs of both languages is different; English has far more CCs than Arabic (Kenworthy 1987, p. 125 and Swan and Smith 2001, p. 197). In the onset syllable or initial consonant clusters (henceforth, ICCs), English ICCs can be made of either two ICCs as in 'stick /stɪk/' or three ICCs hence, usually the first consonant sound is /s/ such as street /striːt/ (McMahon 2002, p. 106) and in the coda syllable or final consonant clusters (henceforth, FCCs) English FCCs can be made up of two FCCs as in 'help /help/', three FCCs such as next /nekst/ or four FCCs as in 'texts /teksts/' (O'Connor 1998, pp. 64-77, Roach 2009, pp. 59-60 and Cruttenden 2014, pp. 260-263). On the other hand, Arabic language syllable structure does not permit ICCs at all (Al-Hattami 2010, p. 360; Swan and Smith 2001, p. 197). Thus, any Arabic onset syllable consists of consonant (henceforth, C) and vowel (henceforth, V) as in /kɪtab/ book, in the coda syllable or FCCs Arabic has only two FCCs such as /bɪnt/ girl (Bishr 2000, pp. 506-510; Swan and Smith 2001, p. 198; Al-Hattami 2010, p. 360).

Al-Hattami (2010, p. 360) states that the difference between English and Arabic phonotactic system is likely to create problems of pronunciation to native speaker of Arabic learning EFL. O'Connor (1998, p. 2) attributes these difficulties to the age in which the learner picks up the characteristic sound of the target language

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(henceforth, TL) as well as to the native language of the learner and its different characteristics from the TL which are quite strong and very difficult to break. Brown, on the other hand, (2007, p. 3) views these errors as an important indicator of the learning process. Thus, the study at hand identifies and analyses Sudanese EFL undergraduates' performance of English phonotactic syllable structure involving ICCs and FCCs. Broselow (1984 as cited in Gass and Selinker 1993, p. 72) asserts that:

> Errors involving consonant clusters generally occur when these clusters must be analysed as belonging to syllable structure which are not permitted in the native language, and that the mispronunciation of the clusters represent an attempt by the language learner to bring second language forms into conformity with first language restrictions defining possible syllable.

Therefore, Sudanese EFL undergraduates insert an epenthetic vowel sound to break the CCs in order to suit their MT language phonotactic system for example the word 'play /pleɪ/' becomes /pɪleɪ/ they intrude the vowel sound /ɪ/ to split the sequence of two ICCs /p/ from /l/ and other example of FCCs is the syllable of /kst/ in the word 'next /nekst/' becomes /nekəst/ or /nekɪst/ they insert the vowel sounds /ə/ or /ɪ/ to split the sequence of three FCCs /kst/ (Swan and Smith 2001, p. 198). This epenthetic vowel insertion is divided into two types: (a) anaptyxis; when a vowel (usually /ɪ/) is inserted to break two consonants cluster as (CVC instead of CC), and (b) prosthesis; when a vowel is inserted before the cluster as (VCC instead of CC). Both types are commonly used to simplify English cluster by speakers of many other languages such as Korean, Kurdish, Amharic, Tiv (spoken in Nigeria), and most Arabic dialects (Darcy and Thomas, 2019; Keshavarz 2017; Gashaw, 2016; Mbha and David, 2014; Al-Samawi, 2014).

The importance of pronouncing and understanding consonant cluster correctly arises due to three crucial roles in every EFL learners endeavor to speak clear English and not be misunderstood. First of all, consonant clusters are in so many English words; basic and advanced vocabulary. If someone mispronounces one, no doubt s/he mispronounces many. Secondly, consonant clusters distinguish between words. Mispronouncing consonant cluster can mean another word for listeners which in turn lead to misunderstanding. For instance, if a speaker omits the /l/ in 'bloat /bləʊt/', 'place /pleɪs/' and 'belt /belt/' they become 'boat /bəʊt/', 'pace /peɪs/' and 'bet /bet/' and the /r/ in 'tree /triː/', track /træk/ and 'drip /drɪp/' they become 'tea /tiː/', tack /tæk/ and 'dip /dɪp/'which are all totally different words in English with different meaning. Thus, consonant clusters are crucially important in telling one word from another. The last reason is that, CCs are essential for pronouncing tense and plural markers. For example, if someone leaves out the /t/ in 'stopped /stɒpt/' and /d/ in 'bagged /bægd/' they become 'stop /stɒp/' and 'bag /bæg/' which lead to miscommunication and the listener does not know the action happed in the past. One and the same, leaving plural 's' off as in 'bed /bed/' and 'client /klaɪənt' instead of 'beds /bedz/' and 'clients /klaɪənts/', are also obvious grammar mistakes. Thus, pronouncing and understanding consonant cluster is essential for speaking clear English that easily understood by others.

To avoid subjectivity, the study at hand uses a computer software program 'Praat' to analyse the participants' speech. Praat allows forming waveforms of the speech sound and spectrograms. Thus, the analysis of this study does not depend on the aural skill or listening of the researcher but is more objective; the whole analysis is computer based.

## 1.1 Statement of the Problem

Sudanese EFL undergraduates perform a large number of pronunciation errors particularly in the phonotactic system of syllable structure involving ICCs and FCCs. Thus many Sudanese EFL undergraduates break the sequence of these clusters by inserting an epenthetic vowel sound to ease their pronunciation and suit their MT language's phonotactic system of the structure of CCs in the onset and coda syllable. Al-Gamal (2018), Keshavarz (2017) and Gashaw (2016) investigate the difficulties that Yemeni, Kurdish and Ethiopian EFL students encounter in pronouncing English CCs and they conclude that their participants face magnitude difficulties pronouncing English CCs, in which as in the problem of the current study, they insert vowel sounds to break the strings of English CCs. That is, they initially insert the high front short vowel /ɪ/ as in /ɪsku:l/ instead of /sku:l/.

## 1.2 Significance of the Study

Pronunciation is one of the most important skills that nearly all EFL undergraduates struggle to master as personally the researcher also struggled. In fact, according to the best knowledge of the researcher, few studies have been carried out in the area of pronunciation errors in the context of Sudan, particularly, the pronunciation of English phonotactic system of syllable structure involving ICCs and FCCs. Therefore, this study is considered to be significant since there have been few attempts made to identify and analyse the nature of phonotactics in English syllable structure involving ICCs and FCCs performed by Sudanese EFL undergraduates.

Thus, the first and foremost significance of this study is to help Sudanese EFL undergraduates in bettering their performance in pronouncing English phonotactic of syllable structure involving ICCs and FCCs and to pay attention to their

pronunciation errors in order to acquire a native-like fluency. Also, it can benefit EFL instructors to have advanced knowledge in their students' pronunciation errors of English syllable structure involving ICCs and FCCs and preparing remedial activities. Moreover, it can benefit textbook writers and syllabus designers to focus on such errors. Furthermore, it contributes to fill in the gap in the literature in the field of phonology as general and more specifically the phonotactic system of English syllable structure involving ICCs and FCCs in the context of Sudan. Finally, it contributes a solution to the problem of pronouncing English syllable structure involving ICCs and FCCs by EFL undergraduates.

## 1.3 Objectives of the Study

The present study aims to devote a greater care to the pronunciation errors of English syllable structure involving ICCs and FCCs performed by Sudanese EFL undergraduates. Thus the objectives are:

1. To identify the magnitude of Sudanese EFL undergraduates understanding and mastering of English phonotactics of words involving ICCs.
2. To identify the magnitude of Sudanese EFL undergraduates understanding and mastering of English phonotactics of words involving FCCs.
3. To explore the causes of the incorrect pronunciation of English words involving ICCs and FCCs as performed by Sudanese EFL undergraduates.
4. To explore the effectiveness of the teaching methods, materials and activities used in teaching the sound system of English language to Sudanese EFL undergraduates.
5. To investigate Sudanese university instructors' awareness towards the importance of age, personality, phonetic ability, motivation and attitude as

pronunciation learning factors in understanding and mastering English pronunciation.

6. To explore the reason of Sudanese EFL undergraduates' failure to correctly pronounce words containing consonant clusters.

## 1.4 Research Questions

The current study is meant to answer the following questions:

1. To what extent do Sudanese EFL undergraduates understand and master English phonotactics of words involving ICCs?

2. To what extent do Sudanese EFL undergraduates understand and master English phonotactics of syllable structure involving FCCs?

3. What are the causes of the incorrect pronunciation of English words involving ICCs and FCCs as performed by Sudanese EFL undergraduates?

4. How effective are the methods, materials and activities used in teaching the sound system of English language to Sudanese EFL undergraduates?

5. To what extent do Sudanese university instructors think pronunciation learning factors (age, personality, phonetic ability, motivation and attitude) play a crucial role in the process of understanding and mastering English pronunciation?

6. Why do you think Sudanese EFL undergraduates fail to correctly pronounce words containing consonant clusters (ICCs or FCCs)?

## 1.5 Research Hypotheses

This study is intended to test the following hypotheses:

1. Sudanese EFL undergraduates face magnitude difficulties in understanding and mastering English phonotactics of words involving ICCs.

2. Sudanese EFL undergraduates face magnitude difficulties in understanding and mastering English phonotactics of words involving FCCs.

3. Unrequired pause between consonant segments in one syllable, vowel insertion and consonant deletion are the causes of the incorrect pronunciation.

4. The teaching methods, materials and activates used in teaching the sound system of English language to Sudanese EFL undergraduates are not effective for improving pronunciation skills and more particularly CCs of the students.

5. Sudanese university instructors think that age, personality, phonetic ability, motivation and attitude play a crucial role in the process of understanding and mastering English pronunciation.

6. The reason of this failure refers to the linguistics differences between the phonotactic system of their MT and the TL.

## 1.6 Research Methodology

The populations of the current study are Sudanese EFL university students and professors. The students are from four different universities; Sudan University of Science and Technology (henceforth, SUST) Al-Neelain University, Almughtaribeen University and Nahda College and they are male and female majoring in English language who have enrolled in their second, third and fourth level of the 2019-2020 academic year. To eliminate other variables, the researcher makes sure that all participants are native speakers of Sudanese colloquial Arabic and from the same background. The latter ones are also from four different universities; Al-Neelain University, Almughtaribeen University, International University of Africa and Nahda College and they are male and female professors and PhD holders in English linguistics. This study utilizes four instruments for the data collection process. Firstly, word-list reading test is used to collect the data from the students. This test contains twenty-four words, which are selected to elicit

each syllable structure involving ICCs and FCCs and administered to the second level students. Samsung mobile phone is used to record the data of the subjects' performance. And a computer software programme 'Praat' is used to analyse the subjects' speech sound by generating waveforms of their speech. The second instrument is a test administered to fourth level students consisting of fifty pseudo-words with initial and final CCs. The third one is a semi-structured interview. And it is composed of six open-ended questions administered to the university instructors. The last instrument is an observation checklist with sixteen items conducted in one-hour-and-a-half lecture with the third level students. A mixed method approach is used to analyse the data. The quantitative method is utilized to analyse the students' test while the qualitative method is utilized to analyse the lecturers' interview.

## 1.7 Delimitations of the Study

The delimitations of this study are as follows:

### 1.7.1  Place Delimitation

This study is limited to SUST, Al-Neelain University, Almughtaribeen University and Nahda College. These higher education institutions are all located in Khartoum the capital of Sudan. The first two universities are where the researcher does his BA and MA and PhD and the last two are where the researcher and his supervisor teach respectively. The first two universities are public and the latter two are private ones.

### 1.7.2  Time Delimitation

The study at hand is limited to 2019/2020 academic year in which the participants of the study are in their second, third and fourth level.

### 1.7.3 Subject Delimitation

This study is limited to 60 second level and 100 fourth level university students; the 60 second level students are fifteen from each above mentioned universities and the 100 fourth level students are 60 from SUST and Al-Neelain University (30 from each) and 40 from Almughtaribeen and Nahda (20 from each) and all of them are EFL students. The other participants are eight university professors.

### 1.7.4 Topic Delimitation

This study is limited to the phonotactics of English phonology particularly syllable structure of CCs.

## 1.8 The Structure of the Study

This study is organized as follows: Chapter one is introduction. It includes the background, problem, significance, objectives, questions, hypotheses, methodology, limitations and structure of the research. Chapter two discusses the theoretical framework and reviews the literature of previous studies related to the subject at hand; the phonology of English phonotactic system of syllable structure with regard to ICCs and FCCs pronunciation errors by EFL undergraduates. Chapter three is research methodology; this chapter presents the method, tools, population, sample, validity, reliability and procedures of the study. Chapter four deals with data analysis and chapter five includes the findings, summary, recommendations and suggestions for future studies.

# CHAPTER TWO

# Theoretical Framework and Literature Review

## 2.0 Introduction

This chapter introduces a thorough and comprehensive idea about the relationship between phonetics and phonology. It also presents the segmental and suprasegmental features of pronunciation. Moreover, it introduces the notion of syllable, the structure of syllable (English and Arabic), types of syllable patterns (English and Arabic) and the Maximal Onset Principle. Furthermore, it presents the phonotactic constraints and the phonological processes of English language. At the same time it accounts the factors that affect pronunciation learning. Additionally, it discusses the theory of 'Error Analysis' (EA) that is related to the current study and which is adopted by the researcher to analyse the cruciality of understanding and mastering English phonotactics of syllable ICCs and FCCs in the performance of Sudanese EFL students. Finally, it reviews the previous studies pertinent to the study at hand which are carried out in EFL/ESL context with particular emphasis on those conducted in the Arab world in the area of English phonotactic system.

## 2.1 The Relationship between Phonetics and Phonology

At first, to get a thorough and comprehensive idea of the way how the sounds of a language function, it needs to study not only the phonetics of the language concerned, but also its phonological system (Collins and Mees, 2013, p. 9). Thus, it is assumed by the researcher that mentioning some definitions about these two important components of linguistics, the science that deals with the study of language, is going to be an asset to distinguish the similarities and differences between these two fields. The distinction usually made between phonetics and

phonology is that phonetics studies the physical aspects of speech sounds, whereas phonology is concerned with patterning these sounds within a language.

At this point, and before discussing the relationship between phonetics and phonology, it is advantageous to sort out the various ways of examining speech sound. According to the transmission of speech signal from a speaker to a listener, phonetics is generally divided into three types. The study of the production or articulation of speech sound is known as **articulatory phonetics** which focuses on the articulator's speech organs such as tongue, lips, teeth, etc. The second one is **acoustic phonetics** which deals with the physical properties of speech signals by concentrating on the sound waves of the signal (air). The last type is termed as **auditory phonetics**, it studies how the ear receives the speech sound and thus its main concern is perception as sometimes referred to as perceptual phonetics.

Collins and Mees (2013, pp. 2, 9, 82) define phonetics as "the science of speech sound and as a term used for the study of sound in human language which provides the data for describing speech". Phonology, on the other hand, is:

> the study of how sounds pattern and function in a given language and as a term used for the study of the selection and patterns of sounds in a single language which produces deeper insights into the structures and patterns of language sound systems (ibid.).

In analogy to these two branches of linguistics, Collins and Mees (ibid., p. 83) liken phonetics as the ingredients (flour, sugar, oil, milk, etc) and phonology as the recipe (cookery book) for baking a cake.

With classifying each field into its business, Widdowson (1996, p. 42) claims that: "the study of allophonic manifestation, how the sounds of speech are actually

made, is the business of phonetics". Whereas "the study of phonemes and their relations in sound systems is the business of phonology". And he concludes that these two fields have to be considered as intrinsically inter-related since the general ideas can be deduced from the actual sounds, and the actual sounds as speech sounds have to be directed to the general ideas they demonstrate.

Another definition for both fields is stated by Tench (2011, p. 4). He declares that "phonetics refers to the pronunciation of the sounds themselves – how they are made, how they differ, how they sound in different positions of a word and how they sound in different combinations, etc. As for phonology, he (ibid.) claims that it:

> refers to pronunciation as a system in itself – how many vowels there are in the spoken form of the language (not the five vowel letters), and how many consonants there are, where the sounds can occur in words, what combination of sounds are allowed, etc.

One more definition with a broad account to phonetics and phonology is introduced by Davenport and Hannahs (2005, pp. 2-3). They state that: "phonetics deals with speech sounds themselves, how they are made (articulatory phonetics), how they are perceived (auditory phonetics), and the physics involved (acoustic phonetics)". Phonology, on the other hand, deals with how these speech sounds are organised into systems for each individual language: for example: how the sounds can be combined, the relations between them and how they affect each other.

As phonetics and phonology are closely connected in the study of pronunciation and speech in general, Kelly (2000) asserts that:

The study of pronunciation consists of two fields, namely phonetics and phonology. Phonetics refers to the study of speech sounds… If phonetics deals with the physical reality of speech sounds, then phonology, on the other hand, is primarily concerned with how we interpret and systematise sounds. Phonology deals with the system and pattern of the sounds which exist within particular languages (p. 9).

Well, it has to be noted that, looking carefully at those definitions; they come to a result that all those who define phonetics and phonology utilize the phrase speech sounds. That is to say, they all share the same idea which says that phonetics and phonology have common similarities.

Again, having a look at the above mentioned definitions, they give a general conclusion that all those researchers, linguists, phoneticians and phonologists define phonology concentrating on the words pattern, and system. Thus, this indicates that nearly all of them share the same opinion which asserts that the business of phonology is the study of how sounds are organized within a language and how they interact with each other. As for phonetics, on the other hand, they concentrate on the physical aspects of the speech sounds, which almost all of them agree with the concrete side of phonetics. So after agreeing upon the similarities of these fields in that both of them deal with human speech sounds, they introduce the differences in which how they look at these speech sounds from different angles.

## 2.2 Segmental and Suprasegmental Features of Pronunciation

A significant and considerable concentration is devoted to the ongoing research of English pronunciation learning and teaching so as to identify the features of pronunciation that affect (speakers') intelligibility and comprehensibility. These features are generally identified and categorised by phoneticians as well as

researchers as either segmental – the feature of individual speech sounds – or suprasegmental – extending over more than one individual sound e.g. syllable structure, stress, rhythm, intonation. Over these two categories, researchers have got a longstanding debate to decide the important category on which teaching pronunciation has to focus and which category is more important in promoting understandable speech. On one side of the debate, Collins and Mees (2013) and Jenkins (2002) support the view which claims that segmental features of pronunciation are far important than their suprasegmental counterpart. For instance, Jenkins (2002, p. 96), based on her empirical study, proposes a Lingua Franca Core of pronunciation teaching. This Core includes five pronunciation features known as 'The Main Core Items' which are suggested to be crucial in promoting intelligibility among interlocutors as well as to have priority in teaching pronunciation. Four of these items are comprised of segmental features, including the general production consonant, phonetic requirement of consonant production (aspiration and phonation), production of consonant clusters and production of vowel. The fifth and the only one is the production and placement of stress which is an item of suprasegmental feature.

On the other side of this debate, researchers such as Tanner and Landon (2009) and Fraser (2001) assert that suprasegmental features are far important than segmental features to intelligibility and comprehensibility. Accordingly, they should be given priority in pronunciation teaching. Fraser (2001, p. 33), for example, mentions six pronunciation features in the order that the communicative approach addresses to be taught based on their importance and impact on listeners' comprehension. She places word and sentence stress high on the list followed by syllable structure (consonant clusters) and at the bottom of the list she lists vowel and consonant distinction respectively.

As this study tackles the process of understanding and mastering English syllable structure of initial and final CCs, it assumes that segmental features of pronunciation should be prioritized above the suprasegmental once. Collins and Mees (2013, p. 215) categorise pronunciation errors which lead to potential break down of intelligibility into six features. Five of these classifications involve segmental features such as confusion of phonemic contrast in the system of vowel sounds, phonetic requirement of consonant contrast, consonant clusters and deletion of /h/. Only word stress is included in their list which represents suprasegmental feature of pronunciation.

Well, having a deeper consideration on the above mentioned classifications, it gives a thorough insight that segmental feature of pronunciation is strongly important and highly advised to be prioritised than their suprasegmental counterparts. Although, some previous studies tend to view suprasegmental feature as more advantageous than the segmental one in the process of teaching pronunciation. By virtue of this study and the context of English pronunciation (phonetics and phonology) in Sudan, the researcher prioritises the segmental features over their suprasegmental counterparts as the study at hand is especially devoted to the phonotactics of English syllable structure of initial and final CCs. Therefore, in order to address English CCs, one should have a comprehensive knowledge of the syllable structure of the language which is the core feature for understanding and mastering CCs (see section 2.4 below).

## 2.3 The Notion of Syllable

The speech sounds of all languages are organised into larger units to represent phonologically a significant grouping of segments called syllable. Every word in English has at least one syllable and many others have two, three, four, five or

more syllables. Syllable is a phonological unit which is challenging to state its exact definition but relatively easy to be aware of (recognise). Almost all adult speakers of English, regardless of their linguistics background, agree that the words phone, phoneme, phonetics, phonotactic, suprasegmental and incomprehensible are comprised of one, two, three, four, five, six syllables respectively.

Inasmuch as syllable is not a complicated concept to understand intuitively, there is a considerable agreement that most people, especially native speakers of a language, are able to easily state with a high degree of reliability how many syllables there are in most words. However, most speakers do not know the importance of syllable to the phonology of their own language. Linguists, on the other hand, have a little consensus about the exact definition of syllable in the phonology of a language. Collins and Mees (2013, p. 16), for example, define syllable in a rough way as "a unit larger than a phoneme and smaller than a word". In a precise way, though, Finegan (2015, p. 126) describes syllable as a phonological unit compromised of one or more sounds which are divided into two components. In general, a syllable is a structural unit in phonology that combines the individual speech sounds (consonants and vowels) in one word according to the phonotactic constraints of a particular language which varies across languages.

## 2.4 The Structure of Syllable

As a researcher, when discussing a syllable, one should be concerned with its two side fact and function; its structure and prominence when it is composed of two or more syllables. As for this study, it discusses the former and excludes the latter which is an asset in the study of stress. In every language, a syllable has a structure which consists of a string of some phonemes of the language. In English, for

instance, the monosyllabic word 'made' is comprised of /m/, /eɪ/ and /d/ respectively and the words 'dame' and aimed which are also monosyllabic, they are composed of the same three phonemes of the word 'made' but they are sequenced differently. Therefore, in discussing syllable structures, one needs to tell not only the structure of specific syllable structures, but also to describe what general structures are allowed in a language and what are not. For example, (from now on, the asterisk * symbol indicates ill-formed word or sequence) */mdeɪ/, */dmeɪ/ or */eɪdm/ are not possible English words as well as syllables inasmuch as there is no CCs of /dm/ or /md/ in English. In Arabic, on the other hand, the sounds /b/, /ħ/, /r/ and /ɪ/ can only make the monosyllabic words 'ربح = profit' /rɪbħ/ and 'حبر = ink' /ħɪbr/.

Despite the fact that languages have varying syllable structures, the vast majority of them share the same core components in building their syllable structures. Thus, across the world's languages, a syllable is generally divided into two parts with varying arrangements. The first part consists of consonant(s) called onset and sometimes termed as the releasing consonant(s). The second part is comprised of two elements called rhyme; sometimes spelled as rime. These two elements are namely nucleus (peak) and coda; the former is the essential element in the structure of a syllable and usually consists of a vowel, the later sometimes referred as arresting consonant(s) is always consonant(s). Traditionally in a technical discussion and tree representation of a syllable structure, the lower case Greek letter sigma with the symbol 'σ' is used instead of the word syllable. The internal structure of a syllable that complies with all languages in the world is illustrated in figure 2.1 below.

```
                    ┌─────────────┐
                    │  σ Syllable │
                    └─────────────┘
                          │    \
                          │     \
                          │    ┌───────┐
                          │    │ Rhyme │
                          │    └───────┘
                          │      /    \
                   ┌───────┐ ┌──────────────┐ ┌──────┐
                   │ Onset │ │ Nucleus (Peak)│ │ Coda │
                   └───────┘ └──────────────┘ └──────┘
```
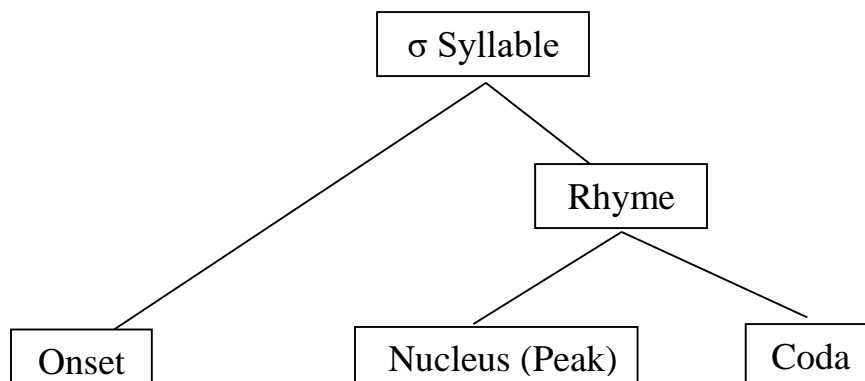
**Figure: 2.1** The general structure of a syllable

## 2.4.1 The Structure of English Syllable

The syllable of English language is considerably different from its Arabic counterpart. In reverse to Arabic syllable, which is relatively simple, English syllables are one of the simplest and most complex ones across languages. Usually, in English, a syllable can be composed of a nucleus only which is usually a vowel (monophthong or diphthong) as in eye /aɪ/, are /a:/ or /ɔ:/ (see figure 2.2), but in some cases consonants can act as a nucleus for a syllable. In English, liquid and bilabial and alveolar nasal consonants sometimes act as a nucleus of a syllable. When English allows those consonants to function as a syllable nucleus in words such as 'bottle' [bɒtˌl], cuddle [kʌdˌl] and rhythm [rɪðˌm], they are called syllabic consonants and marked with a diacritical sign [ˌ] placed under the consonants or often transcribed with the central short vowel schwa /ə/ as in /rɪðəm/ (see figure 2.3). Thus, in the presence of syllabic consonants in a syllable and there is no vowel (monophthong or diphthong), these consonants are marked as V and not C. Henceforth, σ, R, O, N, Co and … stands for symbol, rhyme, onset, nucleus, coda and no onset/coda respectively, in these and the following tree representations of syllable structures.
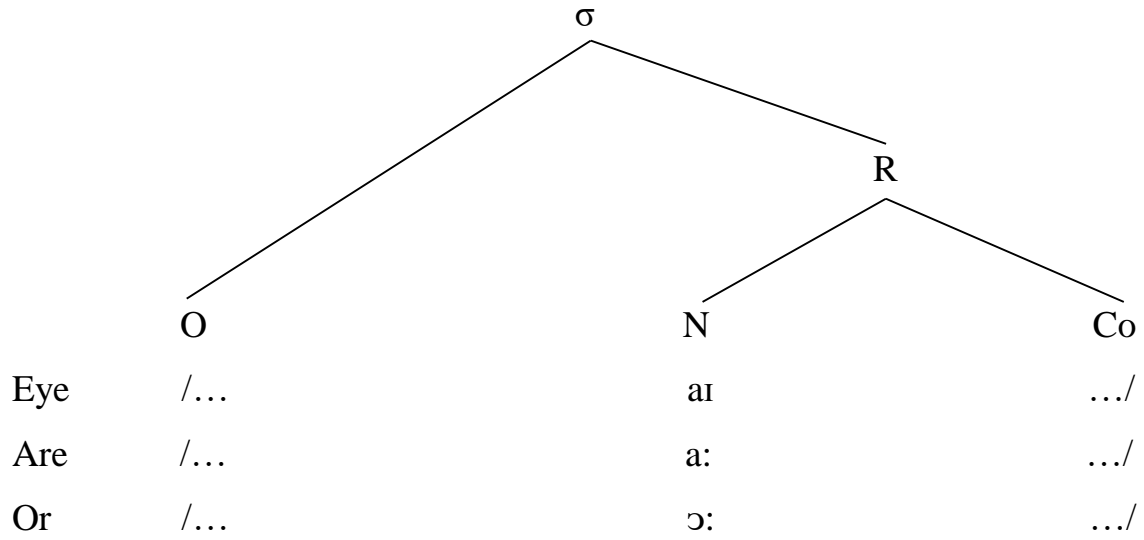
**Figure 2.2** English syllable structure with nucleus (monophthong and diphthong) only
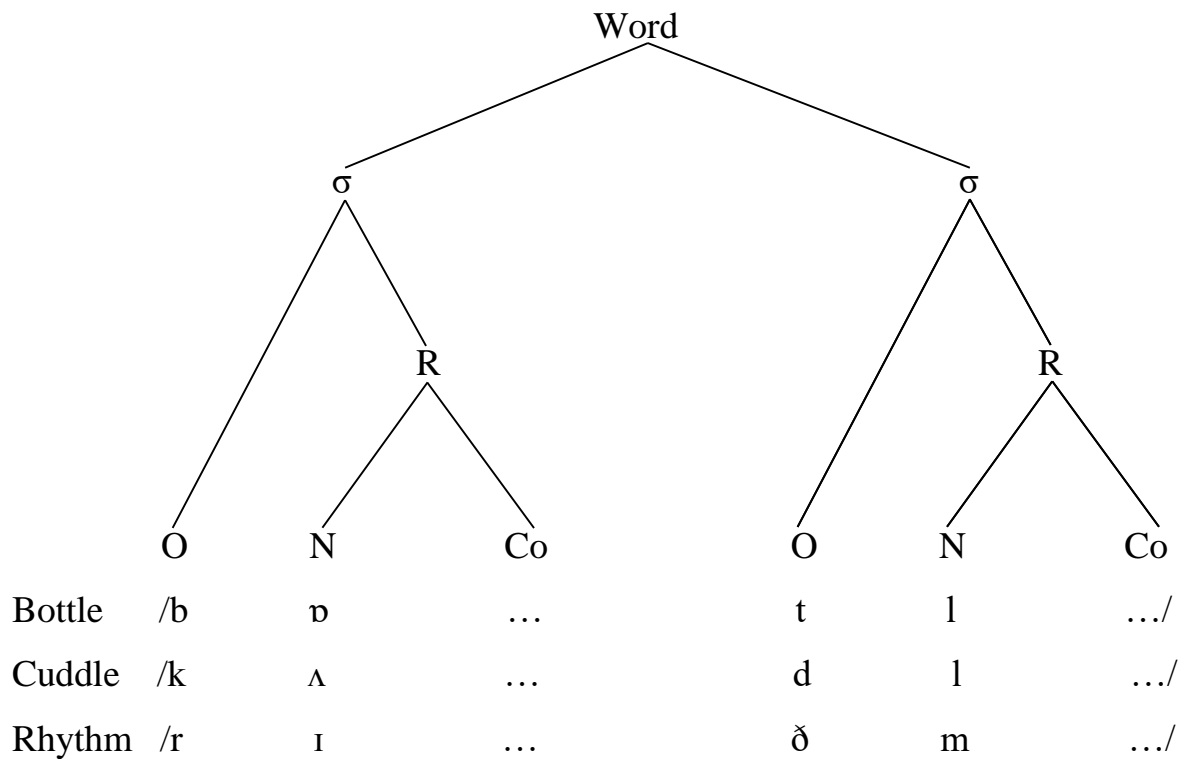


**Figure 2.3** English syllable structure with nucleus (syllabic consonants) only

Unlike most languages including Arabic, the onset, which is every sound that comes before the nucleus, can be compromised of up to three consonants in the initial position – take into account the phonotactics of ICCs (see section 2.7.4 below for the permissible ICCs). This means that the phonology of English permits a syllable to begin with one, two, or three consonants as in /sɪt/ 'sit', /blu:/ 'blue' and /stri:t/ 'street' respectively (see figure 2.4 below). In the final position, the coda, which is every consonant sound that comes after the nucleus, can be composed of maximally four consonants, again take into consideration the phonotactics of FCCs (see section 2.7.5 below for the permissible FCCs) i.e. the phonology of English permits a syllable to end with one, two, three or four consonants as in /tɪk/ 'tick', /stænd/ 'stand', /tekst/ 'text' and /teksts/ 'texts' respectively (see figure 2.5)



|        |       |    |     |
|--------|-------|----|-----|
|        | O     | N  | Co  |
| Sit    | /s    | ɪ  | t/  |
| Blue   | /bl   | u: | …/  |
| Street | /str  | i: | t/  |
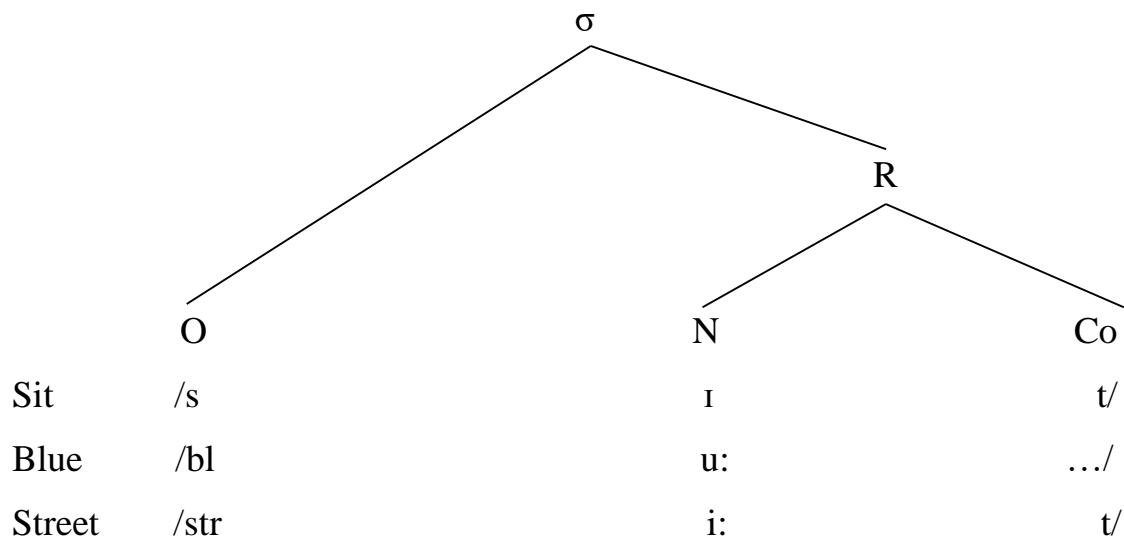
**Figure 2.4** English syllable structure in the onset position

```
                            σ
                 ╱                    ╲
                                       R
                                   ╱        ╲
         O                        N          Co
```

| Tick  | /t  | ɪ | k/    |
|-------|-----|---|-------|
| Stand | /st | æ | nd/   |
| Next  | /n  | e | kst/  |
| Texts | /t  | e | ksts/ |
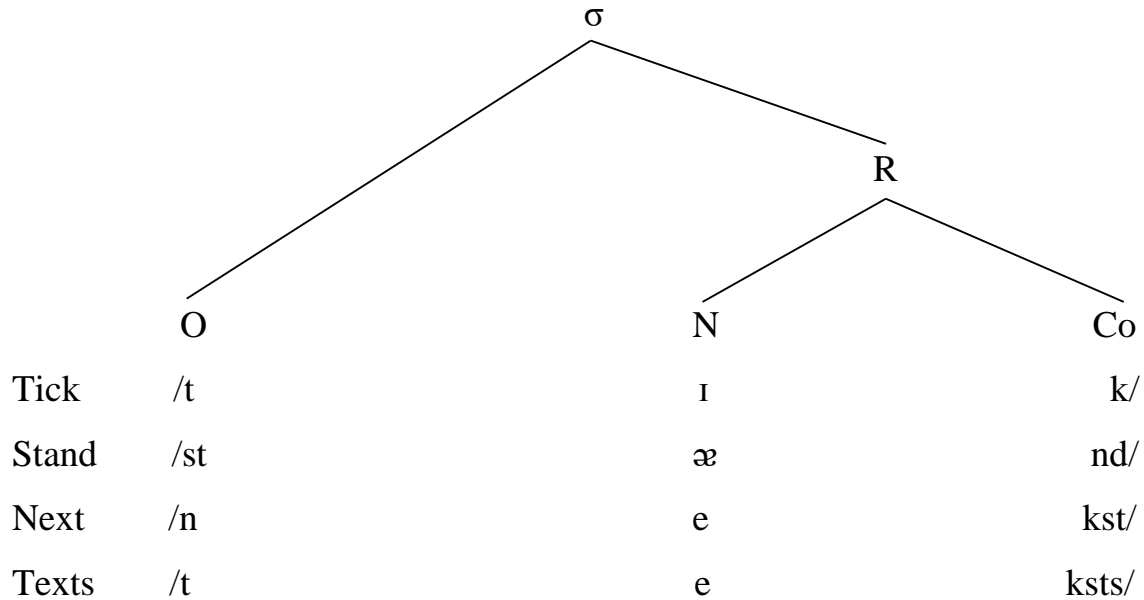
**Figure 2.5** English syllable structure in the coda position

On the basis of the above shown figures, the general internal formula for the structure of English syllable can be stated more concisely as $C_{0-3}$ V $C_{0-4}$.

## 2.4.2 The Structure of Arabic Syllable

Arabic syllable structure is slightly simple across languages. As opposed to English syllable, which can start with a vowel and have a nucleus only, Arabic phonology does not permit its syllable to start with a vowel or have a nucleus only (see section 2.7.3 below for the phonotactic restrictions of Arabic syllable). Arabic syllable structure, in contrast to English also, it does allow its nucleus to be composed of syllabic consonants as in the case of English; i.e. it has to be only vowels (short or their long counterparts). In the onset position, Arabic syllable is composed of only one consonant sound followed by the nucleus immediately as in /mɪn/ 'من' means 'from'; i.e. it cannot be more than one consonant sound as it is permitted in English up to three (see figure 2.6 below) (Ghador, 2008, pp. 156-7; Al-Ani, 1970, p. 84). On the right margin of a nucleus, the coda can consist of

maximally two consonants. This means that Arabic phonology permits a syllable to end with only one or two consonants as in /sɪn/ 'سن' means 'tooth' and /bæħr/ 'بحر' means 'river' (see figure 2.7 below) which is also unlike English coda that can have up to four FCCs.



من = from    /m                      ɪ                     m/
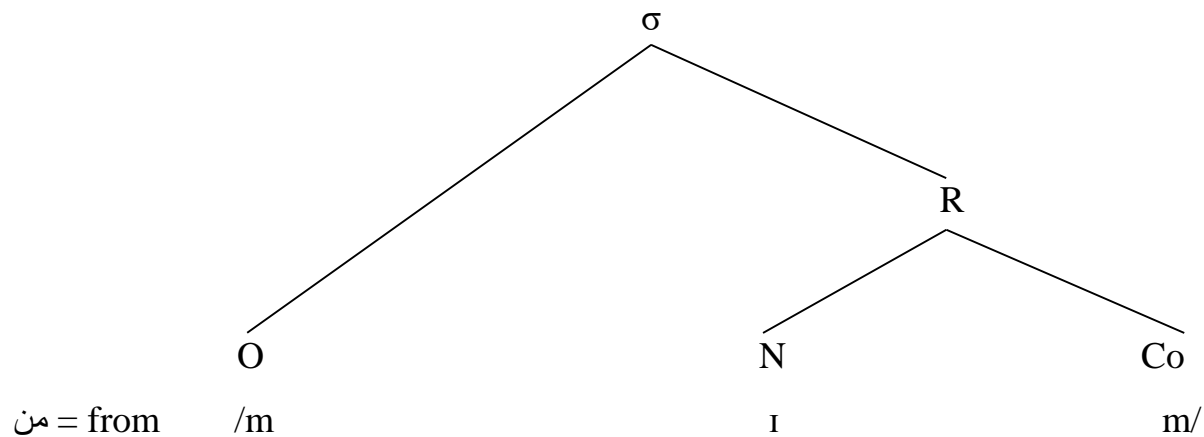
**Figure 2.6** Arabic syllable structure in the onset position



سن = tooth    /s                     ɪ                     n/

بحر = river    /b                     æ                     ħr/
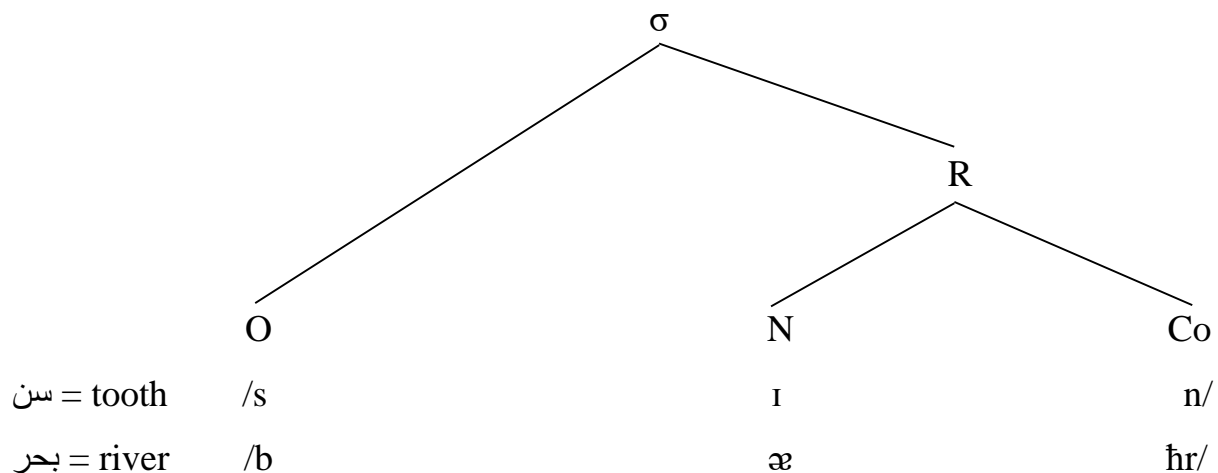
**Figure 2.7** Arabic syllable structure in the coda position

On the basis of the above shown figures, the general internal formula for the structure of Arabic syllable can be stated more concisely as $C_1 \, V \, C_{0-2}$. Table 2.1 below summarises the typology of English and Arabic syllable structure.

**Table 2.1** English and Arabic syllable structure

| Language | Onset | Onset Clusters | Nucleus with Syllabic Consonants | Coda | Coda Clusters | Inventory |
|---|---|---|---|---|---|---|
| English | O | O | O | O | O | (CCC) V (CCCC) |
| Arabic | R | P | P | O | O | C V (CC) |

**O** = optional **P** = prohibited **R** = required

## 2.5 Types of Syllable Patterns

In addition to having variations concerning the structure of syllable, the number of sounds which are permitted to occur in either sides of the nucleus and which speech sound(s) are allowed to occur together or in certain positions (see section 2.7, 2.7.1. 2.7.2. 2.7.3 and 2.7.3 below for these restrictions), languages differ from each other in terms of the syllable pattern and its complexity that they permit. This means that languages vary by utilising different types of syllable patterns in their templates. Across the world's languages, including English and Arabic, a CV pattern of syllable which one of the simplest ones, is considered to be the most common template.

Although, Polish, for instances, has onsets and codas of up to four consonants. Georgian is also reported to have maximally of six onset consonant clusters, (Collins and Mees, 2013, p. 79). English phonology, on one hand, is said to have one of the simplest (V only) as well as the most complex (CCCVCCCC) template of syllable patterns. Taking into consideration all the above mentioned information and the coming phonotactic constraints of English phonology, one can list the following selections of English syllable pattern which by far is regarded as having

the largest number of these templates (see table 2.2 below). Hence, cross-linguistically, all syllables end in a vowel are known as open syllables and those which end in consonant/s are termed as closed syllable. Bear in mind that some not all of these templates can occur in initial, medial or final position of a word; as a part of polysyllabic words.

**Table 2.2** Patterns of English syllable

| | | Examples | |
|---|---|---|---|
| **Syllable Pattern Inventory** | | **Phonemic Transcription** | **Word** |
| 1. | V | /aɪ/ | eye |
| 2. | VC | /ɔːt/ | ought |
| 3. | VCC | /ækt/ | act |
| 4. | VCCC | /ækts/ | acts |
| 5. | CVCCCC | /teksts/ | texts |
| 6. | CV | /nəʊ/ | know |
| 7. | CVC | /θɔːt/ | thought |
| 8. | CVCC | /send/ | send |
| 9. | CVCCC | /tɑːsks/ | tasks |
| 10. | CCV | /flaɪ/ | fly |
| 11. | CCVC | /dres/ | dress |
| 12. | CCVCC | /dræft/ | draft |
| 13. | CCVCCC | /twelfθ/ | twelfth |
| 14. | CCVCCCC | /glɪmpst/ | glimpsed |
| 15. | CCCV | /spreɪ/ | spray |
| 16. | CCCVC | /strɪːt/ | street |

| 17. | CCCVCC | /skrætʃ/ | scratch |
|---|---|---|---|
| 18. | CCCVCCC | /skrɪpts/ | scripts |
| 19. | CCCVCCCC | /stju:dnts/ | students |

With regard to word length and number of syllables, most English words, which are frequently used, revolve around one to seven syllables maximally; the lowest number of syllables has the highest rate of frequency and highest number of syllables has the lowest number of frequency. The highest number of syllables in English words is found in the 45 and 29 letters words 'pneumonoultramicroscopic-silicovolcanoconiosis' and 'floccinaucinihilipilification' with 29 and 12 syllables respectively. But with the exclusion of technical (as in the case of the first word) and coined (as in the case of the second one) words, the word 'antidisestablishmen-tarianism' which has 11 syllables (see figure 2.8 below) is considered as the longest non-technical and non-coined English word while the word /skrætʃt/ 'scratched' is one of the longest monosyllabic words as represented below in figures 2.9.
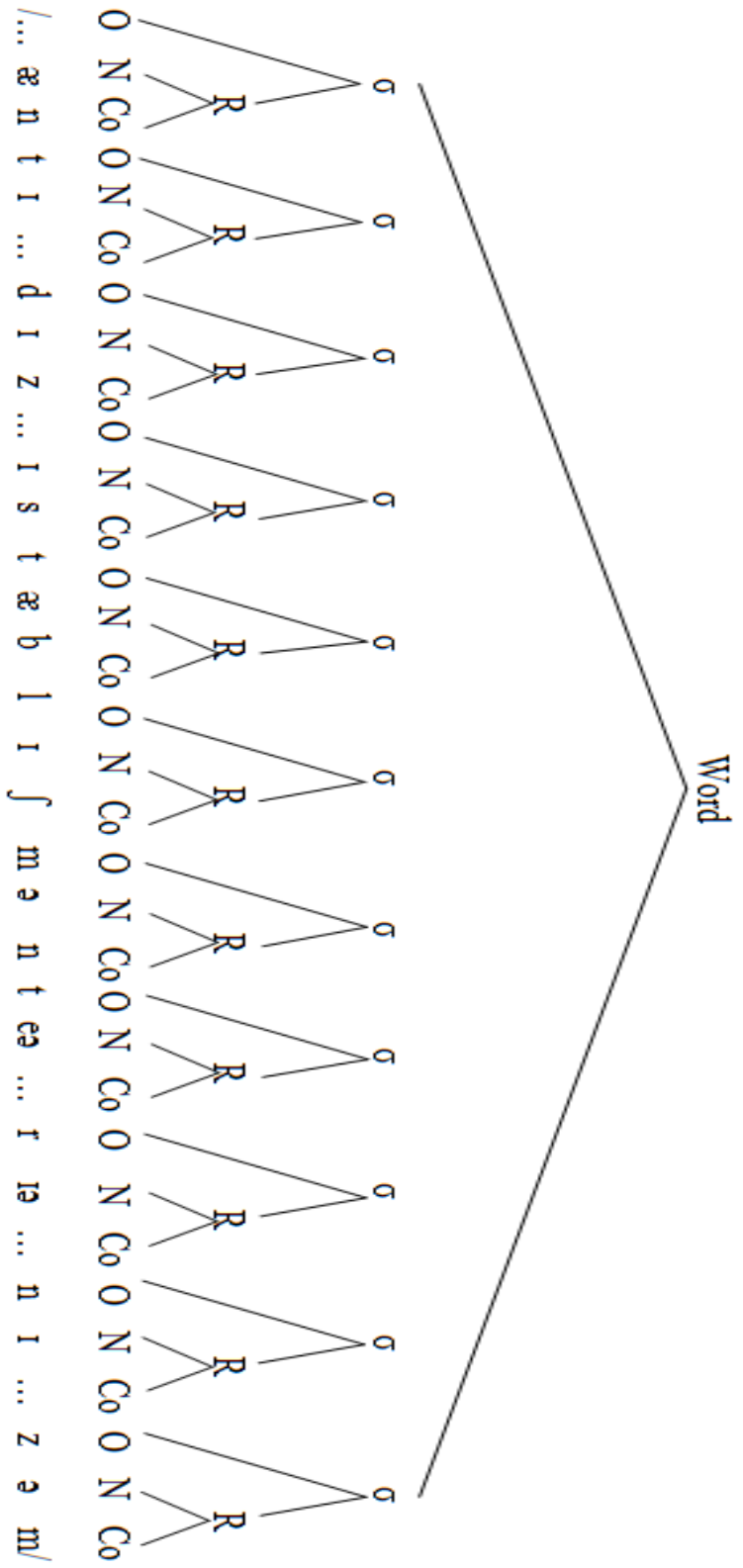
**Figure 2.8** Syllable division of the word antidisestablishmen-tarianism

```
                        σ
                       /  \
                      /    \
                      |     R
                      |    / \
                      |   /   \
                      O   N    Co
Scratched /skr        æ        tʃt/
```
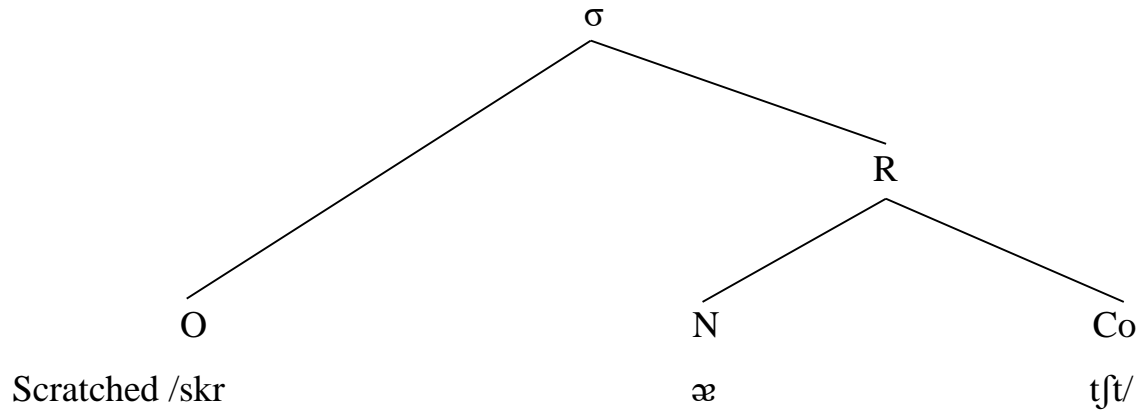
**Figure 2.9** Syllable division of the word scratched

On the other hand, Arabic phonology has a very limited number of syllable patterns and less complex templates as compared to English. Thus, in reverse to English, which has about nineteen different templates of syllable patterns, Arabic syllable pattern as asserted by many linguists such as Anis (1961, p. 92), Al-Ani (1970, p. 87), Shaheen (1993, pp. 107-8), Hilal (1988, pp. 144-5) and Ghador (2008, p. 157-8) has no more than five templates. Although, some linguists such as Al-Ani (1970/1983, p. 133) and Omar (2006, p. 301) claim that it has six patterns. Taking into account all the above mentioned details and the coming phonotactic constraints of permitted Arabic syllable structure (see section 2.7.3 below for the permitted Arabic syllable structure), the following five templates are the only syllable patterns in Arabic phonology (see table 2.3 below). Hence, in these templates VV indicates to a long monophthong vowel.

**Table 2.3** Patterns of Arabic syllable

| Syllable Pattern Inventory | | Example | | |
|---|---|---|---|---|
| | | Phonemic Transcription | Arabic Word | English Meaning |
| 1. | CV | /bɪ/ | بـ | *in* |
| 2. | CVC | /kæm/ | كم | *how much / many* |
| 3. | CVV | /la:/ | لا | *not / no* |
| 4. | CVVC | /ba:b/ | باب | *door* |
| 5. | CVCC | /ʃæms/ | شمس | *sun* |

Bear in mind that the first four templates can occur in initial, medial or final position of a word except the fifth which occurs only finally and in isolation. As for the length and number of syllables, almost all Arabic frequently used words revolve around two to four syllables maximally. The highest number of syllables, with the addition of as many suffixes and prefixes as possible, in Arabic words would be no longer than seven syllables as in 'أنلزمكموها' /ʔænʊlzɪmʊkʊmu:ha:/ (see figure 2.10 below) which means 'shall we compel you to accept it'.
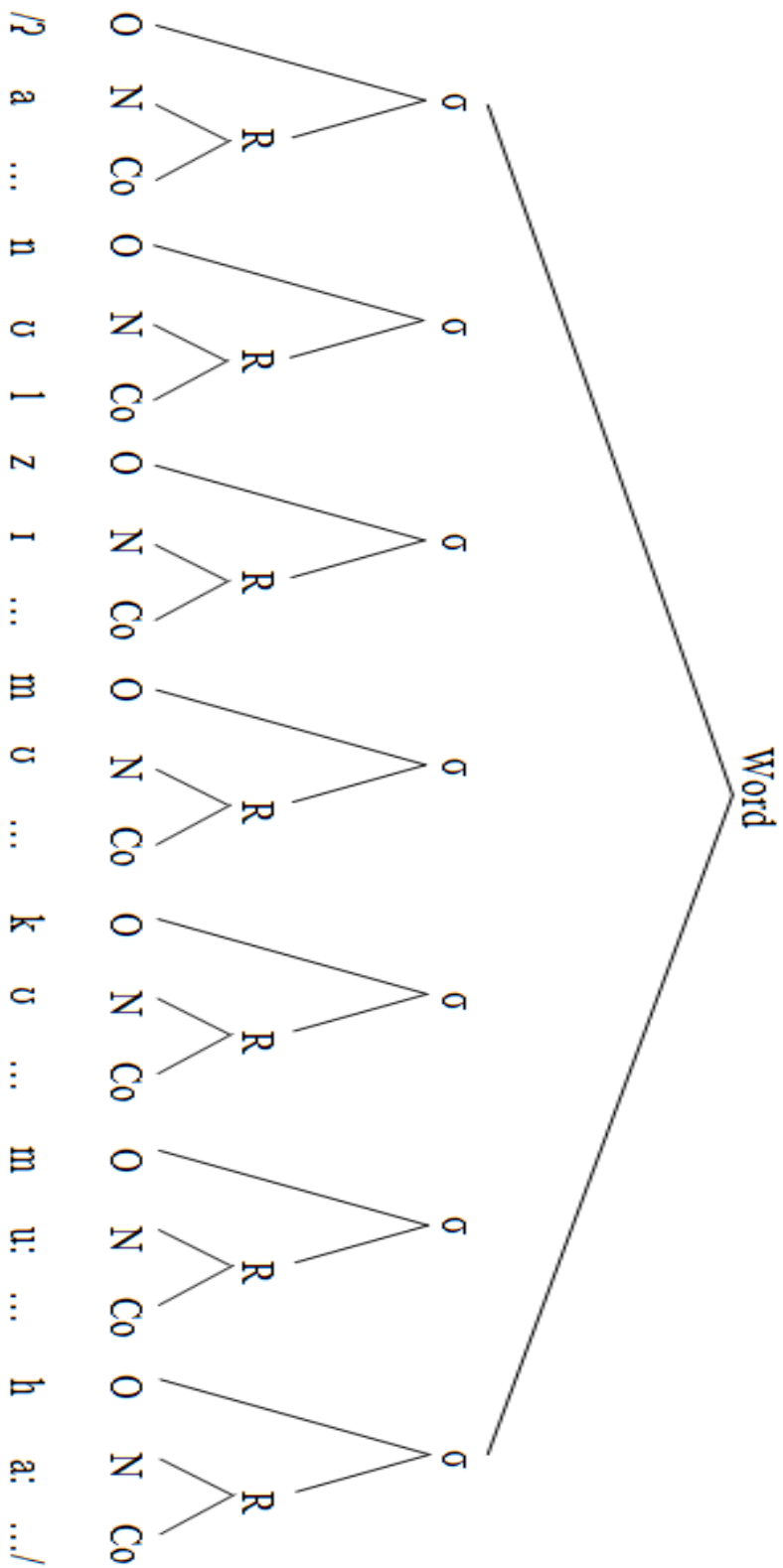
**Figure 2.10** Syllable division of the word أنلزمكموها' /ʔænʊlzɪmʊkʊmu:ha:/

## 2.6 Maximal Onset Principle

Despite the simplicity of counting how many syllables a particular word has (of course sometimes with the help of the nucleus), it is often confusing to intuitively state where a syllable ends and the next one begins (syllable boundary) in a polysyllabic word; to decide which sounds belong to which syllable in a word with more than one syllable and more precisely an intervocalic (consonant/s between vowels) cluster. When English speaker is asked to split a polysyllabic word such as 'abstract' /æbstrækt/ into syllables, they face challenges with the intervocalic consonants. For example, should they split up the consonants /bstr/ (1) as a coda of the first syllable */æbstr.ækt/ (from now on the dot indicates syllable division marker), (2) as the onset of the second syllable */æ.bstrækt/ or (3) should they simply divide them into both positions /æbs.trækt/ or /æb.strækt/?

Based on this division, the first assumption is impermissible English coda as long as these four consonants never cluster to form English coda. Apart from the first open syllable with the short vowel /æ/ violates the rule of stressed syllables, the second assumption is also disallowed onset in English, so long as English phonotactics restricts onset to be not more than three consonants. However, with regard to English final and initial sequence constraints, the last assumption /æbs.trækt/ and /æb.strækt/ would form possible English syllables as long as they do not violate its phonotactic system.

Thus, the phonotactic system of the language gives an invaluable asset and clue to answer such questions of syllabification and syllable boundary. Codas, as in many languages, are highly restricted or even disallowed as in Hawaiian (Gussenhoven and Jacobs, 2017, p. 48). In many other languages, onsets are obligatory components of a syllable as in Arabic (Ghador, 2008, p. 160). While in others, all

syllables must consist of an onset and a nucleus which means that they lack codas (Yavaş, 2011, p. 138).

All these facts indicate that, cross-linguistically, onsets are prioritized over codas. For this priority, it is assumed that any series of intervocalic consonants are assigned to an onset rather than a coda position. This assumption is applicable whenever there is indeterminacy on syllables with cluster of consonants so that the syllable on the right ends up with the maximal admissible number of consonants that satisfies the requirements of English ICCs. As a matter of fact, there is highly reliable evidence in the structure of English syllables which supports the above mentioned assumption that is the application of Maximal Onset Principle is the applicable solution to the problem of syllabification.

MOP in short, implies that when there is a syllable with intervocalic consonants in a particular word, the choice is always to place as many consonants as possible to the onset and as few as possible to the coda (McMahon, 2002, p. 111). However, keep in mind that these clusters do not violate the phonotactic constraints of the language. This means that the word 'abstract' /æbstrækt/ which is syllabified above with two different and yet possible English syllables, is syllabified as in figure 2.12 below rather than in figure 2.11 by appealing to the MOP which assigns /str/ to the onset of the second syllable (Radford, et al., 2009, pp. 81-2). Thus, the syllabification in figure 2.12 is the result of assigning the maximal number of permissible consonants in an onset.

Word

σ                                              σ

R                                              R

O          N          Co          O          N          Co
*/…        æ          bs          tr         æ          kt/
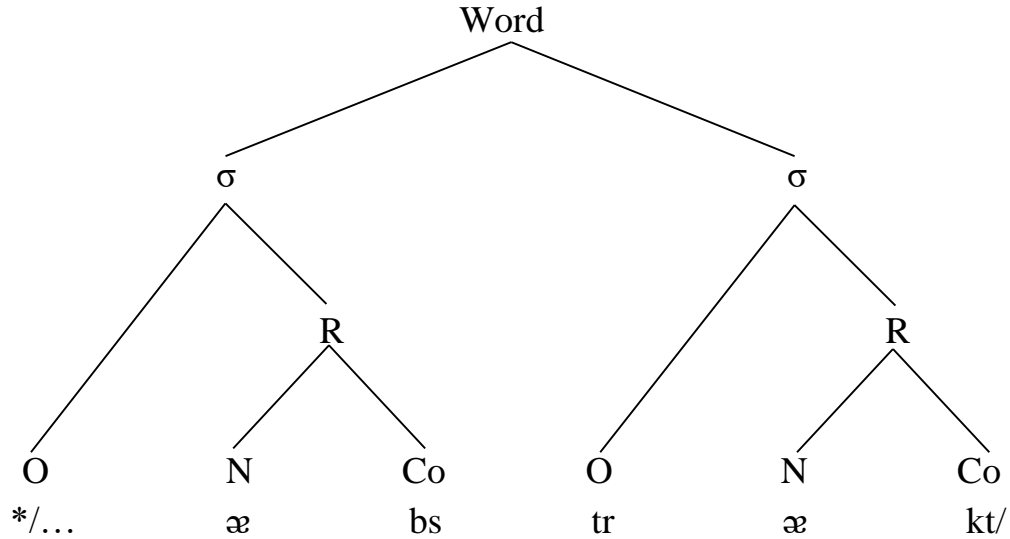
**Figure 2.11** Non-maximised syllable division of the word abstract

Word

σ                                              σ

R                                              R

O          N          Co          O          N          Co
/…         æ          b           str        æ          kt/
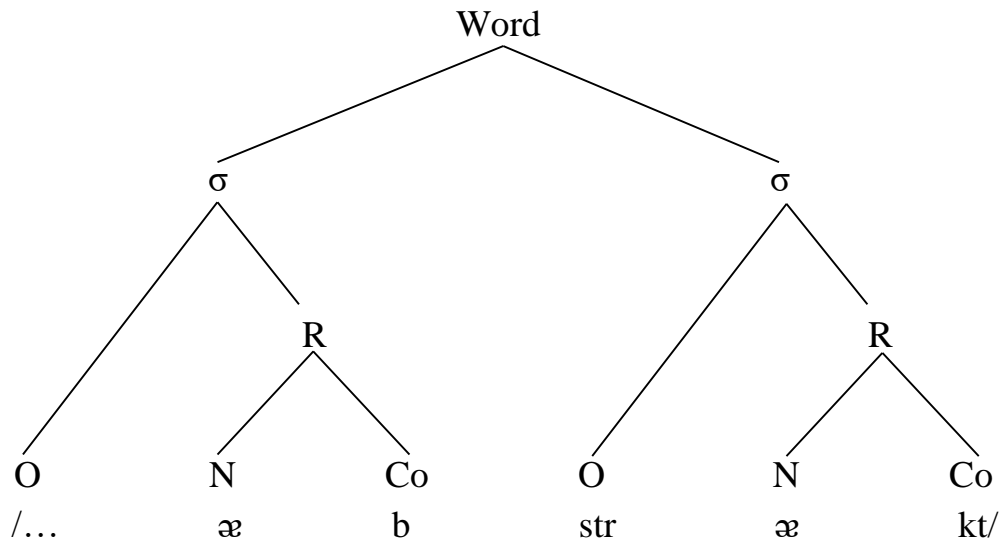
**Figure 2.12** Maximised syllable division of the word abstract

## 2.7 Phonotactic Constraints (Phonotactics)

It is well known that as languages vary in their sound inventories (how many sounds do they have), they also vary in the sound sequences they allow; which sounds are allowed to occur next to each other (Zsiga, 2013, p. 199; Abobaker, 2006, pp. 83-84). Thus, when a person knows a language, s/he also needs to know

how the sound system of that language functions. Therefore, languages are subject to phonotactic constraints which is a term used to refer to the licit and illicit sequences of phonemes in a language. Fasold and Linton (2006) indicate that these strings are not random: rather they are systematic and predictable and they are governed by the languages' phonotactic constraints (p. 41).

Phonotactics, the broad term for phonotactic constraints, is a branch (subtitle under the umbrella) of phonology and dividing this term into its morphological components, it gives its actual meaning as (phono = sound, tacti = touching and cs = pertaining to the study of). So, phonotactics is concerned with the study of the permissible strings (possible combinations) of phonemes in a language. According to Crystal it is "the sequential arrangements of phonological units which occur in a language" (2008, p. 366). On the other hand, Richards and Schmidt (2010, p. 435) define it as the organization of sound units in a language. As, Somlensky and Legendre (as cited in Zsiga, 2013, p. 222) liken phonotactics in the epigraph as a social habit "phonotactics might be considered as the social habit of speech sounds: what sounds go together, and where they can be found?"

To show the systematic nature of speech sounds one can compare the digits 1, 2, 3 with the sounds /æ/, /k/, /t/ to make different combinations of numbers and words respectively. With reference to the three digits, one can make 123, 321 and 231, and with the three sounds, one can make /ækt/ 'act', /kæt/ 'cat' and /tæk/ 'tack'. Although, the above mentioned digits can produce more possible numbers, not every combination of the above sounds is a possible word: 132, 312 and 213 are all valid numbers, but */ktæ/, */tkæ/ and */ætk/ are not. The sound sequence of /ktæ/, /tkæ/ and /ætk/ violates the phonotactic constraints of English; English words never begin with two plosive sounds as in the case of */ktæ/ and */tkæ/ (see section 2.7.4 below for the permissible ICCs) and never end with alveolar and velar plosive

sequence as in the case of */ætk/ while the opposite is permissible (see section 2.7.5 below for the permissible FCCs).

One of the most widespread phonotactic restrictions across languages for middle and final consonant clusters as stated by Zsiga (2013, p. 223) is that "Nasal must agree in place of articulation with a following plosive". Despite the fact that there are some exceptions, the final consonants of the words /kæmp/ 'camp', /peɪnt/ 'paint' and /wɪnd/ 'wind' follow a general pattern of bilabial plosive preceded by bilabial nasal and alveolar plosives preceded by alveolar nasal. With regard to velar plosives, although the word /θɪŋk/ 'think' is written with the alveolar nasal /n/ followed by velar plosive /k/, it is actually pronounced with the velar nasal /ŋ/ followed by velar plosive /k/ (ibid.). Hence, the voiced bilabial and velar plosives are excluded in this generalisation due to two-consonant final cluster constraints (see section 2.7.5 below for the permissible FCCs). Those exceptions occur only when affixation process is applied, but there is no a monomorphemic word (a word with only one part) in English that violates this generalisation. For instance, English has the words /blɪnk/ 'blink' and /ræmp/ 'ramp', but it does not have */blɪmk/ *'blimk' as compared with blink and */rænp/ *'ranp' as compared with ramp. As it is asserted by Zsiga (ibid.), this case is called positional neutralization; nasals do not contrast in place of articulation when they are followed by plosives in two FCCs.

Also, in English, two plosives cannot come at the beginning of words, nor can plosive plus nasal combinations. So, in order to pronounce the borrowed words 'Ptolemy' and 'gnostic' more easily, English speakers simply drop the first consonant and pronounce the words as /tɒləmɪ/ and /nɒstɪk/, respectively (Dawson and Phelan, 2016, p. 149). Alternatively, other speakers may insert a vowel between the two consonants, as in the pronunciation of the words 'Gdansk' and

'knish' as /ɡədænsk/ and /kənɪʃ/ (see section 2.7.4 below for the licit and illicit ICCs). Both of these alterations eliminate violations of the phonotactic constraints of English under a phonological processes termed as deletion and insertion respectively (see section 2.8 below for these processes).

The phonotactic constraints of a language will generally apply to every word in the language, native or not. Therefore, languages seek to overcome problems of borrowing a foreign word that violates their phonotactics. Another similar constraint in one syllable is that strings of obstruents must agree in phonation with the following sounds whether in two or three FCCs; i.e. voiceless + voiceless (+voiceless) or voiced + voiced (+voiced) (Yavaş, 2011, p. 145). Abobaker (2006, p. 85) states that Arabic phonotactics also restricts the occurrence of some consonant sounds to touch each other. For instance, neither the sounds 'ج' /dʒ/ and 'ق' /q/, nor the sounds 'غ' /ɣ/ and 'ع' /ʕ/ occur next to each other in one word.

### 2.7.1 Consonant Constraints

Another example of English phonotactic constraints is that; all English consonants can occur in the onset of a syllable (at the beginning of a word) except the velar nasal /ŋ/ and the post-alveolar fricative /ʒ/ never starts English word. But, the post-alveolar fricative /ʒ/ does occur in words borrowed from other languages especially names; no native English words begin with /ʒ/ (Cruttenden, 2014, pp. 259-60; Kreidler, 2004, pp. 88-9). Biologically, however, these two sounds may easily be pronounced in an onset position, but the sound pattern of English (i.e. the speaker's knowledge of English phonotactics) restricts him/her to pronounce such forms and the speaker does not ingest words containing such kinds of sounds in that position (Hazen, 2015, p. 84). Furthermore, any consonant may occupy final position except /h, j, w/. Collins and Mees (2013, p. 79) include /r/ to the previous three

sounds as it is never pronounced in final position except in some English varieties whose /r/ is rhotic such as American and Scottish English. Arabic phonotactic constraints as in many other Semitic languages, on the other hand, allow all consonant sounds to occur as an onset of syllable, but never allow a vowel to take that position (Fasold and Linton 2006, p. 42; Hayes, 2009, p. 257; Ghador, 2008, p. 160; Omar, 2006, p. 307; Abobaker, 2006, p. 48; Hilal, 1988, p. 211). Alternatively, as it is stated by Abobaker (2006, p. 84), Arabic permits its sounds both consonants and vowels to occupy final position.

## 2.7.2 Vowel Constraints

English phonotactic restrictions are applied not only to consonant sounds, but also are applied to limit the sounds that are permitted to follow vowel sounds (Fasold and Linton, 2006, p. 41; Cruttenden, 2014, pp. 259-260). For example, the diphthong /aʊ/ which is found in many words in English such as /daʊt/ 'doubt', /laʊd/ 'loud', /gaʊn/ 'gown', /haʊs/ 'house', /kraʊtʃ/ 'crouch', /maʊθ/ 'mouth' (as a noun), /maʊð/ 'mouth' (as a verb) /haʊl/ 'howl', /gaʊdʒ/ 'gouge', and /blaʊz/ 'blouse', but there are no words preceded by the diphthong /aʊ/ and followed by /p, b, k, m, g, etc/. So the diphthong /aʊ/ can only be followed by /t, d, s, z, n, θ, ð, tʃ, dʒ/. Thus, a preferable way to demonstrate this phonotactic restriction is that the diphthong /aʊ/ can only be followed by a coronal consonant – articulated with the tip or blade of the tongue. As long as all the above listed sounds that follow the diphthong /aʊ/ share one phonetic property (all made with the apical or laminal part of the tongue), they are attributed to a phonological rule which operates with groups of sounds termed as natural classes. Moreover, all vowel sounds can occur initially except the /ʊ/ and /ʊə/ occur only in foreign proper nouns such as, /ʊpsɑ:lə/ 'Uppsala' and /ʊədʊ/ 'Urdu' (Cruttenden, 2014, p. 260). In reverse to

this, all vowel sounds can occur in final position except /e, a, ɒ, ʌ/ do not occur finally (ibid., pp. 259 and 261).

### 2.7.3 Syllable Constraints

In addition to having constraints concerning which particular sounds are permitted to occur in certain positions, languages have phonotactic constraints regarding syllable structures and types. A syllable is composed of an onset (a consonant or consonant clusters) and rhyme, the latter is divided into two parts known as the nucleus which is the heart of a syllable and coda (a consonant or consonant clusters) (Collins and Mees, 2013, p. 77) (see section 2.4 and 2.5 below for different structures and types of syllable). Almost all languages, as in English, oblige their syllables to have a nucleus which is usually a vowel (Hayes, 2009, p. 251; Ghador, 2008, p. 156; Kreidler, 2004, p. 71; Widdowson 1996, p. 43), they also restrict their syllable to have limited types of syllable as well as limited numbers, types and order of consonants and consonant clusters in both initial and final positions. One of the most common type of syllable across languages is the one which is made up of a consonant followed by a vowel (CV) (Hazen, 2015, p. 82; Collins and Mees, 2013, p. 78; Hayes, 2009, p. 257) as in /nəʊ/ 'know' in English and /kætæbæ/ 'he writes' in Arabic which has three CV syllable (Dawood, 2001, p. 129).

Reed and Levis (2015) assert that languages differ not only in their types of syllable, but also in the occurrence of their sounds which can only be identified in terms of syllable and its structure (p. 87). For instance, the glottal and velar nasal sounds occur in English as in many other languages. However, in English /h/ can only occupy the onset (never the coda) of a syllable as in /help/ 'help' and /bɪ.heɪv/ 'behave'. Nevertheless, there are languages such as Arabic for example, where /h/

occupies the coda of a syllable as in /wærdh/ 'وردة' means 'rose'. Notice that, when a person analyses the structure of a syllable s/he is only concerned with the sounds of the word not its spelling which it is irrelevant for such kind of analysis. Therefore, many English words end with the letter 'h', but this letter never exemplifies /h/ sound. So, when /h/ ends a syllable, it may be silent as /ʧiːtə/ cheetah, or it may work in combination with other letter ('th', 'ph', 'gh', 'ch', 'sh') to form /θ, f, ʧ, ʃ/ as in /pɑːθ/ 'pa**th**', /fəʊtəgrɑːf/ 'photogra**ph**', /lɑːf/ 'lau**gh**', /rɪʧ/ 'ri**ch**' and /fɪʃ/ 'fi**sh**'. In a similar way, while /ŋ/ occupy the coda of a syllable as in /sæŋ/ 'sang' and /rɪŋ/ 'ring', it cannot occupy the onset of a syllable. However, in other languages such as Fijian, Malay/Indonesian, Māori, Thai, and Vietnamese, it occurs in the onset of a syllable; for example, /ŋuː/ in Thai means 'snake' (ibid., pp. 87-88)

As for consonants cluster in one syllable, some languages allow a syllable to begin with more than one consonant. For instance, English permits up to three consonants in the onset of a syllable and up to four consonants (though it is rare) in the coda of a syllable (Yavaş, 2011, p. 139; Roach, 2009, p. 57; O'Connor, 1980/2013, pp. 45-46) (see section 2.7.4 and 2.7.5 below for the licit ICCs and FCCs). All these sequences, however, are not haphazard; they are subject to other constraints that allow which sounds can compose each cluster. Reed and Levis (2015) affirm that there are also differences in sound combination between languages which can only be recognised in terms of syllable and its structure (p. 89). For example, the sounds /p, f, l/ exist in both English and German. In English they occur in '*hipflask',* but when they are analysed, they actually occur in two syllables as the /p/ ends the first syllable and the /fl/ begins the second. In German, on the other hand, /p, f, l/ can occur in one syllable (as an onset) as in '*pflegen'* means 'to be accustomed to do something'. Thus, as both languages have all three

sounds, both of them have the string of /p, f, l/ in one word, in German they are the onset of a syllable, but in English they are in two different syllables (ibid., p. 88).

Arabic phonotactic constraints, on the other hand, permits no consonant clusters initially at all (Shaheen, 1993, p. 108; Ghador, 2008, p. 160). As in reverse to English also, it only permits up to two consonants in the coda position as in /sæbr/ means 'patience' (Al-Ani, 1983, p. 121). In accordance with the vowels and consonants, the number of syllables in one word is subject to the vowel therein. There is a wide variety of syllable types in English, such as V, CV, CCV, CCCV, VC, VCC, VCCC, CVC, CCVC, CCCVC, CVCC, etc. (Collins and Mees, 2013, p. 78) (see section 2.5 above for the different types of syllable patterns).

Other languages, however, do not have such large numbers of permitted syllable structures. Arabic, for instance, has no more than six types; three with short vowels as (CV, CVC, and CVCC) and the same types with the short vowels are duplicated with their long counterpart as (CVV, CVVCC, and CVVCC): hence, VV = long vowel. Although, the last type of the first three (CVCC) is more restricted as it only occurs when it is pronounced in isolation (ibid., p. 133). Ghador (2008, pp. 157-158) and Shaheen (1993, pp. 107-108), on the other hand, claim that Arabic syllable is only composed of five types by excluding the last one.

As stated by Yavaş (2011, p. 131), phonological knowledge of syllable structure (rule) has an important role with respect to the phonotactics in languages. Thus, based on this knowledge, speakers of English can judge any forms as possible or impossible words. For instance, both */blɪt/ and */bmɪt/ does not exist in English, but if one asks a native speaker of English to judge these two words as possible and impossible, s/he without hesitation will choose the first as possible and the later as impossible (ibid.). This is due to the phonotactic restrictions of English that

permit plosive plus lateral approximant sequence initially as in /blu:/ 'blue', whereas disallowing bilabial plus nasal sequence (Zsiga, 2013, p. 223). However, this is not to say that no English word can have a /bm/ strings. Yavaş (2011, p. 131), on the other hand, affirms that words such as /sʌbməri:n/ 'submarine' and /sʌbmɪʃn/ 'submission' demonstrate the fact that English can have /bm/ sequence, but this occurs only in different syllables as these words are composed of three syllable (see figure 2.13 and 2.14 below).
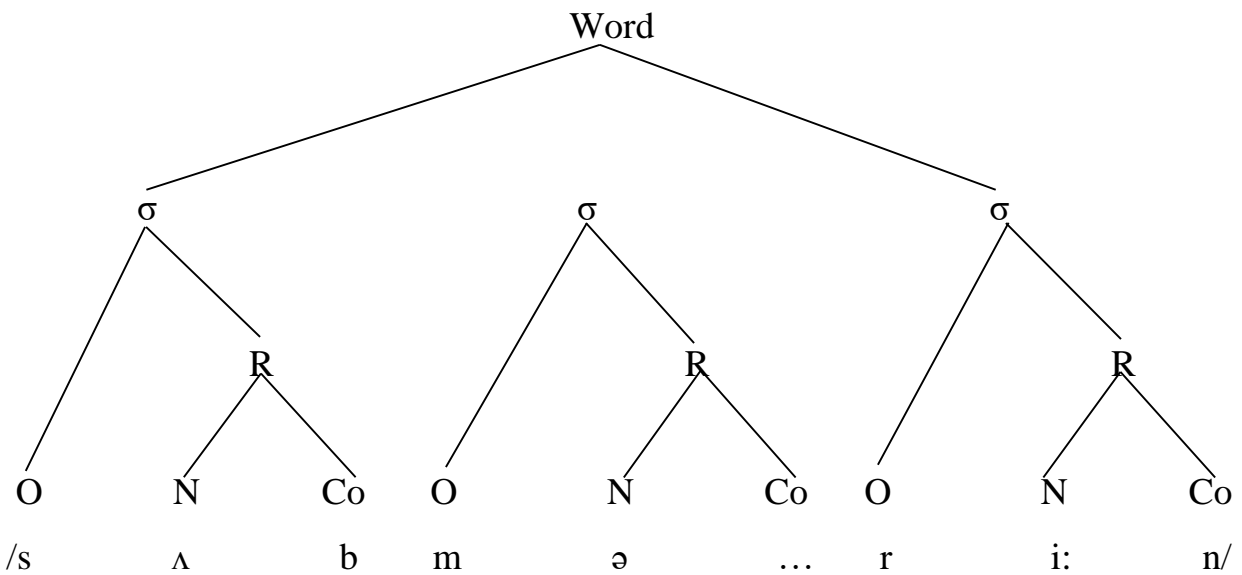


**Figure 2.13** Syllable division of the word submarine
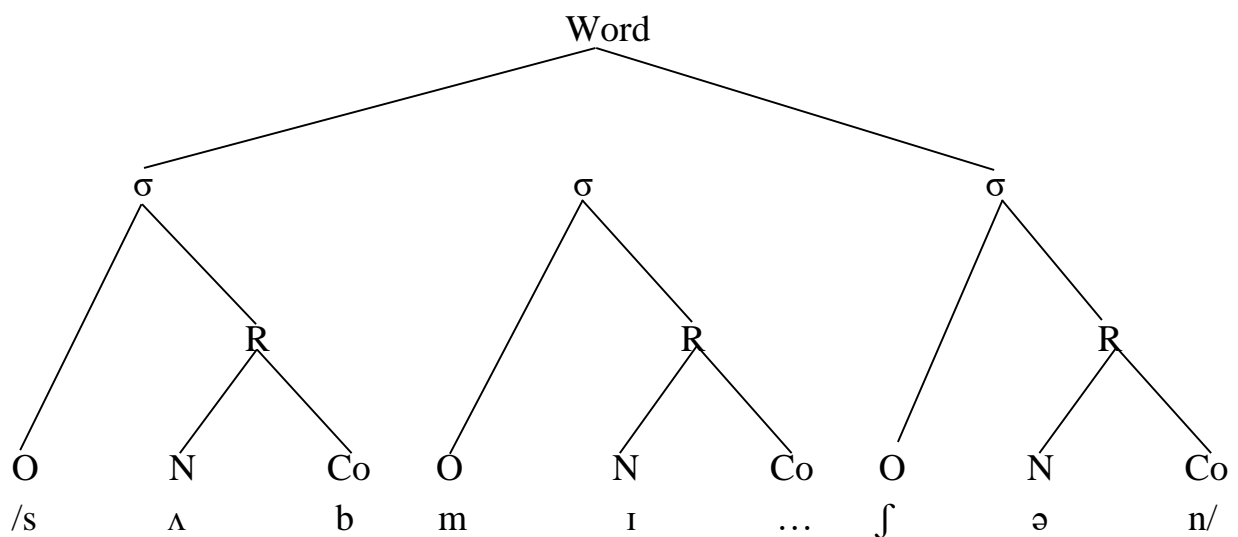


**Figure 2.14** Syllable division of the word submission

### 2.7.4 Initial Consonant Clusters Constraints

With regard to this study which deals with English syllable structure in terms of its initial and final CCs, phonotactic restrictions are also applied on these two strings. As it is mentioned in section 2.7 above, the occurrence of CCs in the onset of a syllable is not random, and it is under certain restrictions. Accordingly, English speakers know what sequences of sounds occur in their language. For instance, those speakers know that the only consonant that comes before bilabial and alveolar nasal at the beginning of a word is the voiceless alveolar fricative as in /snu:p/ 'snoop' and /sməʊk/ 'smoke' which are perfect combinations of /n/ and /m/ preceded by /s/ respectively (Davenport and Hannaha, 2005, p. 172).

On the other hand, /pn/ and /ps/ strings which are perfect way to start a word in Greek as 'pneumonia' and 'psychology' by pronouncing both initial sounds, and despite the fact that these two words exist in English, they are not pronounced in the same way as in Greek (Fasold and Linton, 2006, p. 43). Even though English permits two ICCs, it is not unrestricted. Thus, English phonotactic constraints illicit the sequences of /pn/ and /ps/ by dropping out the voiceless bilabial (making them silent) in their pronunciation of ICCs. Thus, as asserted by Zsiga (2013, p. 233), the strings eliminate by phonotactic constraints diversify from language to language. For example, Collins and Mees (2013, p. 79) assert that English permits neither plosive plus nasal nor nasal plus plosive strings in initial position.

In English, the initial cluster of consonants that form the onset constituent is composed of two or three consonants (Odden, 2013, p. 314). To make it simple, the two consonant clusters can further be divided into two main types. The first type is formed with obstruents, lateral approximant or bilabial and alveolar nasals followed by a lateral approximant or approximant. However, not all obstruents in

the onset can be followed by a lateral approximant or approximant. That is, /p, b, t, d, k, g, f, v, s, θ, ∫, h, m, n, l/ can only be followed by /l, r, w, j/: hence, not all these clusters are possible (Hazen, 2015, p. 84; O'Connor, 1980/2013, pp. 64-65). See table 2.4 below for the possible and impossible combinations which is adapted from Hazen (2015, p. 85) Yavaş (2011, p. 141) and Cruttenden (2008, p. 259) along with examples from O'Connor (1980/2013, pp. 64-66), Roach (2009, p. 58) and Cruttenden (2008, p. 261). Hence, again, the voiceless alveolar fricative is the sound that composes the second type of two ICCs, but with more choices. Before leaving this sequence, it is important to point out that while the palatal approximant frequently serves as second consonant in initial double CCs, it almost occurs only before /u:/ or /ʊə/ (Cruttenden, 2008, p. 261).

The voiceless alveolar fricative, and despite its presence in the previous sort as it is followed by /l, r, w, j/, it is the base for the second sort of two ICCs. Therefore, this voiceless alveolar sibilant can be combined with voiceless plosives, labiodental fricatives or bilabial and alveolar nasals (Hazen, 2015, p. 84; O'Connor, 1980/2013, pp. 64-66). That is, /s/ followed by /p, t, k, f, v, m, n, l/. For this sort also see table 2.5 below for the possible and impossible combinations which is adapted from Hazen (2015, p. 85) Yavaş (2011, p. 141) and Cruttenden (2008, p. 259) along with examples from O'Connor (1980/2013, pp. 65-66), Roach (2009, p. 58) and Cruttenden (2008, p. 259) as for /s/ + /l, r, w, j/ see table 2.4 below.

**Table 2.4** Two ICCs (C + /l, r, w, j)

| | l | r | w | j |
|---|---|---|---|---|
| p+ | play /pleɪ/ | pray /preɪ/ | puissance /pwiːsens/ | pure /pjʊə(r)/ |
| b+ | blow /bləʊ/ | bring /brɪŋ/ | boite /bwat/ | beauty /bjuːti/ |
| t+ | | try /traɪ/ | twin /twɪn/ | tune /tjuːn/ |
| d+ | | dress /dres/ | dwell /dwel/ | due /djuː/ |
| k+ | climb /klaɪm/ | cry /kraɪ/ | quick /kwɪk/ | cure /kjʊə(r)/ |
| g+ | glass /glɑːs/ | green /griːn/ | guano /gwɑːnəʊ/ | gules /gjuːlz/ |
| f+ | fly /flaɪ/ | from /frɒm/ | | few /fjuː/ |
| v+ | vlog /vlɒg/ | vroom /vruːm/ | voyeur /vwaɪɜː(r)/ | view /vjuː/ |
| s+ | slip /slɪp/ | | swim /swɪm/ | sue /sjuː/ |
| θ+ | | throw /θrəʊ/ | thwack /θwæk/ | thulium /θjuːliəm/ |
| ʃ+ | schlep /ʃlep/ | shriek /ʃriːk/ | schwa /ʃwɑː/ | |
| h+ | | | | huge /hjuːdʒ/ |
| m+ | | | moi /mwɑː/ | music /mjuːzɪk/ |
| n+ | | | noire /nwɑː/ | news /njuːz/ |
| l+ | | | | lewd /ljuːd/ |

**Keys: Green** = freely occurs **Orange** = occurs in recent import words **Purple** = finds only in one word

**Blank box** = impossible combination

**Table 2.5** Two ICCs (/S/ + C)

| | p | t | k | f | v | m | n |
|---|---|---|---|---|---|---|---|
| s+ | spin /**spɪn**/ | stay /**steɪ**/ | score /**skɔː(r)**/ | sphere /**sfɪə(r)**/ | svelte /**svelt**/ | smile /**smaɪl**/ | snack /**snæk**/ |

**Keys: Green** = freely occurs **Orange** = occurs in recent import words

For three-consonant initial cluster, the first element invariably must be the voiceless alveolar fricative, the second elements are voiceless plosives, and lateral approximant or approximants occupy the last position (Collins and Mees 2013, p. 78; Roach, 2009, p. 57). That is, /s/ followed by /p, t, k/ and /l, r, w, j/. Although this sequence can potentially make up to twelve possible combinations only five actually occur freely due to other consonant constraints (Yavaş, 2011, p. 142; Cruttenden, 2008, p. 261). The sequences /spw/, /stl/, and stw/ never exist, the first does not exist because /w/ cannot occur before labials, the second also does not occur because no lateral approximant after alveolar plosives, as the last one also violates English phonotactic constrains of consonant cluster (ibid.). Two consonant plus /j/ combinations /spj, stj, skj/ as mentioned in the previous string are also restricted and they only occur before /uː/ or /ʊə/ as in /scuːbə/ 'scuba', /stuːpɪd/ 'stupid' and /skʊə/ 'skewer' (Cruttenden, 2008, p. 261). The last restricted combination of this cluster is /skl/ which is rare and occurs only before /ə/ as in /sklərəʊsis/ 'sclerosis' and /sklərɒtik/ 'sclerotic' (ibid.). See table 2.6 below for the possible and impossible combinations which is adapted from Hazen (2015, p. 85) Yavaş (2011, p. 141) and Cruttenden (2008, p. 259) along with examples from O'Connor (1980/2013, p. 67) and Roach (2009, p. 57).

**Table 2.6** Three ICCs

| | | L | r | w | j |
|---|---|---|---|---|---|
| s+ | p+ | splay /**spleɪ**/ | spread /**spred**/ | | spew /**spjuː**/ |
| | t+ | | straight /**streɪt**/ | | stew /**stjuː**/ |
| | k+ | sclerosis /**sklɪərəʊsɪs**/ | screw /**skruː**/ | squeak /**skwiːk**/ | skewer /**skjuːə(r)**/ |

**Keys:** **Green** = freely occurs  **Blank box** = impossible combination

## 2.7.5 Final Consonant Clusters Constraints

As stated by O'Connor (1980/2013, p. 67), FCCs are more diverse than their initial counterparts. This is mainly because of three reasons; the appending of (a) /s/ or /z/ as plural, possessive and third person singular present simple markers, (b) /t/ or /d/ as past and past participle markers, and (c) /θ/ ordinal number marker. As stated earlier, the possibility of FCCs can form up to four consonants at the end of a syllable. As for two-consonant final cluster, it can be divided into two sorts; suffixed and non-suffixed (Yavaş, 2011, p. 143). Non-suffixed two FCCs can further be branched into four types as shown below by Yavaş (ibid.).

a. Nasals plus all obstruents except /b, g, v, ð, ʒ, h/. That is /m, n, ŋ/ + /p, t, d, k, f, s, z, θ, ʃ, tʃ, dʒ/. Hence in this sequence nasals as $C_1$ are invariably homorganic with plosive as $C_2$ in their place of articulation. Although there are some exceptions, the normal pattern is that bilabial nasal is followed by bilabial plosives, alveolar nasal is followed by alveolar plosives as for velar nasal and despite the fact that is written with /n/, it is actually pronounced as /ŋ/ therefore it is followed by velar plosives Zsiga (2013, p. 223). See table 2.7 below for the possible and impossible combinations.

b. Voiceless alveolar sibilant plus voiceless plosives. That is, /s/ + /p, t, k/. See table 2.8 below for the possible and impossible combinations.

c. Voiceless bilabial or velar plosives plus voiceless alveolar obstruents. That is, /p, k/ + /t, s/. The voiceless labiodental fricative is also clustered with the voiceless alveolar plosive. That is, /f/ + /t/ See table 2.9 below for the possible and impossible combinations.

d. Lateral approximant or post-alveolar approximant plus any consonants except /g, z, ʒ, ð/ and those which are illicit to occur finally (see section

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2.7.1 above for the licit and illicit final consonants). That is, /l/ or /r/ + /p, b, t, d, k, f, v, s, θ, m, n, ŋ, ʃ, ʧ, ʤ/. The latter (post-alveolar approximant) is only occurred in rhotic English such as American, Scottish etc.) Thus, it is excluded for this study which adopts Received Pronunciation (henceforth, RP). See table 2.10.a and 2.10.b below for the possible and impossible combinations.

Before leaving this sort of two non-suffixed FCCs and as it is asserted by Odden (2013), it is important to indicate that there are certain constrains on this sort of final cluster (p. 314). (a) Cluster of nasal as $C_1$ plus voiced plosive as $C_2$, the plosive invariably must be noncoronal. Thus, /frɪnʤ/ and /hænd/ are licit while /*læmb/ and /*haŋg/ with pronouncing the /b/ and /g/ respectively are illicit clusters. (b) The lateral approximant can follow /r, w, j/ but never occurs after a nasal. (c) Nasals can only occur after /l, r, w, j/. Again, the post-alveolar approximant is only pronounced in rhotic English such as American, Scottish etc.

Notice: All the tables below are adapted from Yavaş (2011, p. 141) and provided with examples from Souza (2015, p. 140) for all tables, O'Connor (1980/2013, pp. 67, 76 and 83) for tables 2.7 and 2.9, Roach (2009, p. 59) for tables 2.7, 2.8 and 2.9 and Oxford Advanced Learner's Dictionary (OALD) 9th edition (2015) for tables 2.10.a and 2.10.b.

**Table 2.7** Two Non-suffixed FCCs (/m, n, ŋ/ + /p, t, d, k, f, s, z, θ, ʃ, ʧ, ʤ/)

| | p | t | d | k | f | s | z | θ | ʃ | ʧ | ʤ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| m+ | bump /bʌmp/ | | | | triumph /traɪʌmf/ | | boldrums /bɒldrəmz/ | | | | |
| n+ | | want /wɒnt/ | find /faɪnd/ | | | sense /sens/ | jeans /dʒiːnz/ | | amensh /əmenʃ/ | punch /pʌnʧ/ | revenge /rɪvendʒ/ |
| ŋ+ | | | | bank /bæŋk/ | | | | | | | |

**Keys: Green** = freely occurs   **Purple** = finds only in one word  **Blank box** = impossible combination

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**Table 2.8** Two Non-suffixed FCCs (/s/ + /p, t, k/)

| | p | t | k |
|---|---|---|---|
| s+ | gasp /gæsp/ | best /best/ | ask /ɑːsk/ |

**Keys: Green** = freely occurs

**Table 2.9** Two Non-suffixed FCCs (/p, k, f/ + /t, s/)

| | t | s |
|---|---|---|
| p+ | kept /kept/ | perhaps /pəhæps/ |
| k+ | act /ækt/ | axe /æks/ |
| f+ | raft /rɑːft/ | |

**Keys: Green** = freely occurs **Blank box** = impossible combination

**Table 2.10.a** Two Non-suffixed FCCs (/l/ or /r/ + /p, b, t, d, k, f, v, s, θ/)

| | p | b | t | d | k | f | v | s | θ |
|---|---|---|---|---|---|---|---|---|---|
| l+ | help /help/ | bulb /bʌlb/ | fault /fɔːlt/ | bald /bɔːld/ | milk /mɪlk/ | shelf /ʃelf/ | shelve /ʃelv/ | else /els/ | health /helθ/ |

**Keys: Green** = freely occurs **Purple** = finds only in one word

**Table 2.10.b** Two Non-suffixed FCCs (/l/ or /r/ + /m, n, ŋ, ʃ, tʃ, dʒ, l/)

| | m | n | ŋ | ʃ | tʃ | dʒ | l |
|---|---|---|---|---|---|---|---|
| l+ | film /fɪlm/ | kiln /kɪln/ | | welsh /welʃ/ | belch /beltʃ/ | bulge /bʌldʒ/ | |

**Keys: Green** = freely occurs **Purple** = finds only in one word **Blank box** = impossible combination

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In other words, as classified by Cruttenden (2008, p. 262), two FCCs also fall into two groups. The first group is formed with nasal, lateral approximant, or voiceless alveolar sibilant as the first consonant followed by any other consonants except /g, v, ð, ʒ, ŋ/ and those which are illicit to occur finally (see section 2.7.1 above for the licit and illicit final consonants) as the second ones. Tables 2.11.a and 2.11.b below illustrate the possible and impossible combinations of two non-suffixed FCCs as adapted from Cruttenden (2008, p. 262) along with examples from Souza (2015, p. 140), O'Connor (1980/2013, pp. 75-76), Cruttenden (2008, p. 262), Roach (2009, p. 59) and Oxford Advanced Learner's Dictionary (OALD) 9th edition (2015).

Yavaş (2011, p. 143) and Cruttenden (2008, p. 262) agree upon the second group which emerges due to the appending of /s, z, t, d, θ/ as morphological process of suffixation to form plural, possessive, third person singular present simple, past and past participle, and ordinal number respectively. Thus, this form can be formed with all possible final English consonant sounds (see section 2.7.1 above for the licit and illicit final consonants) as the first consonant plus /s, z, t, d, θ/ as the second one. The voiceless dental fricative occurs in some words not as ordinal marker, but as noun marker such as /depθ/ 'depth'. There are also some monomorphemic words which involve the sounds /s, z, t, d, θ/ as a second consonant, actually they are part of the word's stem not suffixes as in /læps/ 'lapse', /ædz/ 'adze', /æks/ 'axe', /ækt/ 'act', /lɪft/ 'lift', /bend/ 'bend', /brɒnz/ 'bronze', /rest/ 'rest', /fi:ld/ 'field'. Hence, two suffixed FCCs consists of obstruent must agree in voicing with the following sound.

Notice, as it is pointed out by Roach (2009) the pronunciation of a two suffixed FCCs of plosive plus plosive such as /gd/ in /bæ**gd**/ 'bagged' and /kt/ in /bæ**kt**/ 'backed' the first plosive is usually pronounced without plosion (p. 59). Table 2.12 below illustrates the possible and impossible combinations of two suffixed FCCs

as adapted from Yavaş (2011, p. 144) and Cruttenden (2008, p. 262) along with examples from Roach (2009, p. 59) and Oxford Advanced Learner's Dictionary (OALD) 9th edition (2015).

**Table 2.11.a** Two Non-suffixed FCCs

| | p | b | t | d | k | f | v |
|---|---|---|---|---|---|---|---|
| m+ | jump /dʒʌmp/ | | | | | lymph /lɪmf/ | |
| n+ | | | bent /bent/ | bend /bend/ | | | |
| ŋ+ | | | | | blank /blæŋk/ | | |
| l+ | pulp /pʌlp/ | bulb /bʌlb/ | belt /belt/ | cold /kəʊld/ | silk /sɪlk/ | self /self/ | evolve /ɪvɒlv/ |
| s+ | clasp /klɑːsp/ | | arrest /ərest/ | | bask /bɑːsk/ | | |

**Keys: Green** = freely occurs **Purple** = finds only in one word **Blank box** = impossible combination

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**Table 2.11.b** Two Non-suffixed FCCs

| | m | n | s | z | ʃ | θ | ʧ | ʤ |
|---|---|---|---|---|---|---|---|---|
| m+ | | | | | | | | |
| n+ | | | once /wʌns/ | bronze /brɒnz/ | amensh /əmenʃ/ | labyrinth /læbərɪnθ/ | | change /ʧeɪndʒ/ |
| ŋ+ | | | | | | strength /streŋθ/ | | |
| l+ | elm /elm/ | kiln /kɪln/ | false /fɔːls/ | | welsh /welʃ/ | wealth /welθ/ | squelch /skwelʧ/ | bulge /bʌldʒ/ |
| s+ | | | | | | | | |

**Keys**: <span style="background-color:#00FF00">**Green**</span> = freely occurs <span style="background-color:#FF00FF">**Purple**</span> = finds only in one word **Blank box** = impossible combination

**Table 2.12** Two Suffixed FCCs

| | S | z | t | d | θ |
|---|---|---|---|---|---|
| p+ | cups /cʌ**ps**/ | | stoped /stɒ**pt**/ | | depth /de**pθ**/ |
| b+ | | absorbs /əbzɔ:**bz**/ | | rub /rʌ**bd**/ | |
| t+ | bets /be**ts**/ | | | | eighth /eɪ**tθ**/ |
| d+ | | beds /be**dz**/ | | | hundredth /hʌndrə**dθ**/ |
| k+ | kicks /kɪ**ks**/ | | backed /bæ**kt**/ | | |
| g+ | | dogs /dɒ**gz**/ | | bagged /bæ**gd**/ | |
| f+ | roof /ru:**fs**/ | | stuffed /stʌ**ft**/ | | fifth /fɪ**fθ**/ |
| v+ | | grieves /gri:**vz**/ | | received /rɪsi:**vd**/ | |
| s+ | | | classed /klɑ:**st**/ | | |
| z+ | | | | amused /əmju:**zd**/ | |
| θ+ | baths /bɑ:**θs**/ | | bathed /bɑ:**θt**/ | | |
| ð+ | | baths /bɑ:**ðz**/ | | bathed /beɪ**ðd**/ | |
| ʃ+ | | | mashed /mæ**ʃt**/ | | |
| ʒ+ | | | | | |
| ʧ+ | | | pitched /pɪ**ʧt**/ | | |
| ʤ+ | | | | caged /keɪ**ʤd**/ | |
| m+ | | arms /ɑ:**mz**/ | | armed /ɑ:**md**/ | warmth /wɔ:**mθ**/ |
| n+ | | bans /bæ**nz**/ | | turned /tɜ:**nd**/ | tenth /te**nθ**/ |
| ŋ+ | | sings /sɪ**ŋz**/ | | ringed /rɪ**ŋd**/ | |
| l+ | | bills /bɪ**lz**/ | | called /kɔ:**ld**/ | |

**Keys: Green** = freely occurs **Blank box** = impossible combination

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Three FCCs as categorised by Yavaş (2011, p. 143) also fall into two groups exactly as the Two FCCs mentioned above, i.e. suffixed and non-suffixed FCCs. With the exception of the words /mɪdst/ 'midst' and /nekst/ 'next' which are composed of three obstruents, all other non-suffixed three-consonant final cluster combinations consist of nasal, lateral approximant or post-alveolar approximant (the latter only applies for rhotic accents) followed by two voiceless obstruents. Hence, not all the combinations are possible. As it is mentioned in section 2.7 and 2.7.5 above, three FCCs composed of obstruents must agree in phonation with the following sound. Table 2.13 below illustrates the possible and impossible combinations of three non-suffixed FCCs along with examples from Yavaş (2011, p. 143).

The second group of this sequence is composed of the plural, possessive, third person singular present simple, past and past participle or ordinal number morphemes as the third consonant of this sort preceded by obstruents (except /g, ð, ʃ, ʒ/) or bilabial and alveolar nasals as the second consonant and nasals, voiceless alveolar sibilant, lateral approximant or post-alveolar approximant as the first consonant (Yavaş, 2011, p. 145). That is, /m, n, ŋ, l, s, r/ as $C_1$ + /p, b, t, d, k, f, v, m, n, s, z, θ, ʧ, ʤ/ as $C_2$ + /s, z, t, d, θ / as $C_3$. Again, the post-alveolar approximant only applies for rhotic accents and it is excluded for this study which adopts RP. Like two FCCs, three-consonant final cluster of obstruents also must agree in phonation. Tables 2.14.a and 2.14.b below illustrate the possible and impossible combinations of three suffixed FCCs along with examples from Souza (2015, p. 140), Yavaş (2011, p. 145), Roach (2009, p. 59), and Oxford Advanced Learner's Dictionary (OALD) 9th edition (2015). Hence, actually occurring clusters have many more combinations than the examples given here.

**Table 2.13** Three Non-suffixed FCCs

| C3 | t, s | | | | |
|---|---|---|---|---|---|
| C2 | l+ | s+ | k+ | t+ | p+ |
| C1 | | | | | |
| d+ | | midst /mɪdst/ | | | |
| k+ | | next /nekst/ | | | |
| m+ | | | | | exempt /ɪgzempt/ |
| n+ | | against /əgeɪnst/ | | | |
| ŋ+ | | | sacrosanct /sækrəʊsæŋkt/ | | |
| l+ | sculpt /skʌlpt/ | whilst /waɪlst/ | | waltz /wɔːlts/ | |

**Keys:** Green = freely occurs  Purple = finds only in one word  **Blank box** = impossible combination

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**Table 2.14.a** Yavaş' Three Suffixed FCCs with Two Non-suffixed FCCs

| C₃ |  | s, z, t, d, θ |  |  |  |  |  |
|---|---|---|---|---|---|---|---|
| **C₂ →** | v+ | f+ | k+ | d+ | t+ | b+ | p+ |
| **C₁ ↓** | | | | | | | |
| m+ | | nymphs /nɪmfs/ | | | | | lamps /læmps/ cramped /kræmpt/ |
| n+ | | | | bonds /bɒndz/ | aunts /ɑːnts/ | | |
| ŋ+ | | | drinks /drɪŋks/ | | | | |
| l+ | involves /ɪnvɒlvz/ devolved /dɪvɒlvd/ | sylphs /sɪlfs/ · engulfed /ɪŋgʌlft/ twelfth /twelfθ/ | sulks /sʌlks/ bulked /bʌlkt/ | builds /bɪldz/ | adults /ædʌlts/ | bulbs /bʌlbz/ | helps /helps/ gulped /gʌlpt/ |
| s+ | | | asterisks /æstərɪsks/ frisked /frɪskt/ | | accost /əkɔːst/ | | crisps /krɪsps/ lisped /lɪspt/ |
| p+ | | | | | adopts /ədɒpts/ | | |
| k+ | | | | | facts /fækts/ | | |
| f+ | | | | | lifts /lɪfts/ | | |

**Keys: Green** = freely occurs **Purple** = finds only in one word **Blank box** = impossible combination

**Table 2.14.b** Yavaş'Three Suffixed FCCs with Two Non-suffixed FCCs

| C1 \ C3 (C2 = s, z, t, d, θ) | m+ | n+ | s+ | z+ | θ+ | tʃ+ | dʒ+ |
|---|---|---|---|---|---|---|---|
| m+ | | | | | | | |
| n+ | | | advanced /ədvænst/ | cleansed /klenzd/ | hyacinths /haɪəsɪnθs/ | branched /brænʧt/ | arranged /əreɪndʒd/ |
| ŋ+ | | | | | | | |
| l+ | realms /relmz/ filmed /fɪlmd/ | kilns /kɪlnz/ | | ballsed /bɔːlzd/ | | mulched /mʌlʧt/ | indulged /ɪndʌlgd/ |
| s+ | | | | | | | |
| p+ | | | collapsed /kəlæpst/ | | | | |
| k+ | | | faxed /fækst/ | | sixth /sɪksθ/ | | |
| f+ | | | | | | | |

**Keys: Green** = freely occurs **Purple** = finds only in one word **Blank box** = impossible combination

The same sequence is also categorised by Cruttenden (2008, pp. 261- 262) into two groups, but in a different way. The first group involves his first classification of two FCCs, i.e. /m, n, ŋ, l, s/ as $C_1$ plus any licit final consonants as $C_2$ plus plural, possessive, third person singular present simple, past and past participle, or ordinal number morphemes /s, z, t, d, θ/ as $C_3$. There are a few monomorphemic words which violate this generalization such as /mʌlkt/ 'mulct' and /kælks/ 'calx'. Tables 2.15.a and 2.15.b below illustrate the possible and impossible combinations of three FCCs with one suffix as adapted from Cruttenden (2008, p. 263) along with examples from Souza (2015, p. 140) and Oxford Advanced Learner's Dictionary (OALD) 9th edition (2015).

The second group involves his second classification of two FCCs plus the plural marker morpheme as $C_3$. Hence, his exceptions for two FCCs are included in this sequence too. For this sequence also, there are two common words (next and text) which are excluded for this generalization, pronounced as /nekst/ 'next' and /tekst/ 'text' respectively (ibid.). But, applying phonological process termed as reduction, (see section 2.8 below for the phonological processes), these two words are reduced to be pronounced without the final voiceless alveolar plosive as /neks/ and /teks/ (ibid.). Table 2.16 below illustrates the possible combinations of three FCCs with double suffix as adapted from Cruttenden (2008, p. 263) along with examples from Souza (2015, p. 140) Roach (2009, p. 59) and Oxford Advanced Learner's Dictionary (OALD) 9th edition (2015). Hence, the examples in table 2.16 below are the only licit words.

**Table 2.15.a** Crittenden''s Three Suffixed FCCs with Two Non-suffixed FCCs

| C₃ C₂ C₁ | s, z, t, d, θ | | | | | | |
|---|---|---|---|---|---|---|---|
| | p+ | b+ | t+ | d+ | k+ | f+ | v+ |
| m+ | lamps /læmps/ jumped /dʒʌmpt/ | | | | | galumphs /gəlʌmfs/ | |
| n+ | | | ants /ænts/ | finds /faɪndz/ | | | |
| ŋ+ | | | | | drinks /drɪŋks/ thanked /θæŋkt/ | | |
| l+ | helps /helps/ pulped /pʌlpt/ | bulbs /bʌlbz/ | belts /belts/ | holds /həʊldz/ | sulks /sʌlks/ milked /mɪlkt/ | gulfs /gʌlfs/; engulfed /ɪngʌlft/ twelfth /twelfθ/ | solved /sɒlvd/ delve /delvz/ |
| s+ | grasps /grɑːsps/ gasped /gɑːspt/ | | ghosts /gəʊsts/ | | asks /ɑːsks/ | | |

**Keys: Green** = freely occurs **Purple** = finds only in one word **Blank box** = impossible combination

**Table 2.15.b** Cruttenden's Three Suffixed FCCs with Two Non-suffixed FCCs

| C₃ | dʒ+ | tʃ+ | θ+ | z+ | s+ | n+ | m+ |
|---|---|---|---|---|---|---|---|
| **C₂** | | | s, z, t, d, θ | | | | |
| **C₁** | | | | | | | |
| m+ | | | | | | | |
| n+ | changed /tʃeɪndʒd/ | punched /pʌltʃt/ | months /mʌnθs/ | cleansed /klenzd/ | danced /dɑːnst/ | | |
| ŋ+ | | | | | angst /æŋkst/ | | |
| l+ | bulge /bʌldʒd/ | belched /beltʃt/ | stealths /stelθs/ | ballsed /bɔːlzd/ | whilst /waɪlst/ | kilns /kɪlnz/ | films /fɪlmz/ |
| s+ | | | | | | | |

**Keys:** <mark>Green</mark> = freely occurs <mark>Purple</mark> = finds only in one word **Blank box** = impossible combination

**Table 2.16** Three Double suffixed FCCs

| C₃ → | s |
|---|---|
| C₂ → | θ+ |
| C₁ ↓ | ▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨ |
| t+ | eighths /eɪ**tθs**/ |
| d+ | hundredths /hʌndrə**dθs**/ |
| f+ | fifths /fɪ**fθs**/ |
| n+ | ninths /naɪ**nθs**/ |
| | tenth /te**nθs**/ |

As for four FCCs which occur rarely, it exists as a result of the suffixation process to three FCCs with /t/ and/or /s/ morphemes (Cruttenden, 2008, p. 262). As for more clarification, four FCCs can be divided into two sorts. The first sort is composed of three non-suffixed FCCs plus plural or present simple third person singular marker and past or past participle marker. While the second one is made up of three suffixed FCCs with /θ/ plus plural marker. Tables 2.17.a and 2.17.b below illustrate the possible and impossible combinations of four FCCs with three non-suffixed and three suffixed FCCs respectively as adapted from Roach (2009, p. 59) along with examples from Souza (2015, p. 140) and Roach (2009, p. 59). Hence, the examples in table 2.17.b below are the only licit words.

**Table 2.17.a** Four FCCs with three Non-suffixed FCCs

| C₄ | t, s | | | |
|---|---|---|---|---|
| C₃ | t+, s+ | | | |
| C₂ | p+ | k+ | t+ | s+ |
| C₁ | | | | |
| k+ | | | | texts /te**ksts**/ |
| m+ | prompts /prɒ**mpts**/ | | | |
| | glimpsed /glɪ**mpst**/ | | | |
| l+ | sculpts /skʌ**lpts**/ | mulcts /mʌ**lkts**/ | waltzed /wɔ:**ltst**/ | |

**Keys**: **Green** = freely occurs **Purple** = finds only in one word **Blank box** = impossible combination

**Table 2.17.b** Four FCCs with three suffixed FCCs

| C₄ | s | | |
|---|---|---|---|
| C₃ | θ+ | | |
| C₂ | d+ | f+ | s+ |
| C₁ | | | |
| k+ | | | sixths /sɪ**ksθs**/ |
| n+ | thousandths /θaʊzə**ndθs**/ | | |
| l+ | | twelfths /twe**lfθs**/ | |

**Keys: Purple** = finds only in one word **Blank box** = impossible combination

## 2.8 Phonological Processes

As it is well known that all human beings speak their MT without prior formal teaching, and yet it is evident that language is a rule-governed. For example, non-

linguist (a person with no linguistic knowledge) might not see any process entails in the formation of the words stick, spoke and skid. However, a linguist without hesitation could specify that on the basis of phonotactics; In English when the $C_2$ in two ICCs is a voiceless stop the $C_1$ invariably must be voiceless alveolar fricative.

Similarly, the plural morpheme must agree in phonation with the preceding sound. Therefore, Davenport and Hannahs (2005, p. 132) attribute these processes to the sound system of the language which characterises these changes in terms of being caused by or being due to some phonological processes and they are termed as phonological processes, phonological rules or phonological alternations. Rowe and Levine (2015, p. 75) specify that the function of these processes is to add, delete, or change elements in the actual form to a form that is easier to pronounce or perceive. For example, the word 'ham' is pronounced as [hæ̃m] instead of [hæm] because the vowel is followed by a nasal consonant that nasalizes the vowel sound when the speaker unconsciously lower his/her velum and opens the nasal cavity before articulating the [m] so as to ease the pronunciation (ibid.).

Phonological rules are across languages phenomenon which are termed according to the kind of the process entails in each word. Shaghi (2016, p. 50) presents the general representation of phonological rule as:

$$A \rightarrow B / C \underline{\quad\quad} D$$

That is **A** = phoneme, **B** = allophone, **C** and **D** = context/environment, → = is pronounced as or becomes, / = in the context/environment and ___ = location of the target sound. Thus this representation can be implemented in the example below:

   a. /pɪt/ → [pʰɪt]

   b. /spɪt/ → [spɪt]

As it is obvious that the second example has no alternations, while in the first one the /p/ becomes [pʰ] i.e. /p/ is pronounced as [pʰ] when it occurs at the beginning of a word. Similarly, this alternation can be applied to the rest voiceless stops. Zsiga (2013, p. 225) affirms that this alternation occurs when the morphemes are put together in different combinations; if a permissible string formed, a change may occur in the way the morpheme is pronounced. In English as well as in many other languages, there are eight major phonological processes, which are going to be discussed in this section along with examples from the phonology of English and other languages.

## 2.8.1 Assimilation

Assimilation, the most common type of alternation, takes place when two adjacent sounds become more similar in quality, as the speech organs used to articulate them becomes more similar too. In other words, Tench (2011, p. 88) defines assimilation as "When an adjustment is made to accommodate an actual phonetic feature in the immediate environment, that process of simplification is known as assimilation". Zsiga divides this process into two sorts: **local and long-distance assimilation** (2013, p. 232). The former occurs when two different sounds become more similar. In English, for instance, the plural and third person singular present simple markers agree in voicing with the preceding sound as in /dɒgz/ 'dogs' and /tɔ:ks/ 'talks'. In /dɒgz/ 'dogs' the plural morpheme /s/ agrees with the voiced preceding sound and pronounced as /z/ instead of /s/ and in the second example /tɔ:ks/ 'talks' the third person singular present simple morpheme /s/ agrees with the voiceless preceding sound and pronounced as /s/ so as to ease the pronunciation process in both examples. Thus, this sort of local assimilation is known as **voicing assimilation**. Another example of voicing is when /l, r, w/, which are usually voiced in English, they become voiceless when they are preceded by voiceless stop

or fricative in the same syllable (Rowe and Levine, 2015, p. 76). The following examples as adapted from Rowe and Levine (ibid.) prove this process (the diacritic symbol [ ̥] indicates devoicing):

a. [p̥reɪ] pray
b. [tw̥ɪn] twin
c. [f̥raɪt] fright

A second sort of local assimilation is termed as **nasal place of articulation assimilation** (Fasold and Linton, 2006, p. 45). Considering the negative prefix 'in-', it can often be pronounced as [ɪn] before vowel and alveolar, and it often becomes [ɪm] before bilabial /m, b, p/, or [ɪŋ] before velar /k,g/. Before a vowel or an alveolar, 'in-' is pronounced [ɪn] as [ɪn.ɔːdəbl̩] 'inaudible', [ɪn.diːsn̩t] 'indecent', [ɪn.tɒlərəbl̩] 'intolerable', [ɪn.sʌfrəbl̩] 'insufferable'. But before the bilabials [m], [b], or [p], it becomes [ɪm] as [ɪm.ɪməʊbaɪl̩] 'immobile', [ɪm.bæləns] 'imbalance', [ɪm.pɒsɪpl̩] 'impossible'. And before the velar [k] or [g], it is usually pronounced [ɪŋ] as in [ɪŋkəˈrekt] 'incorect'. The phonotactic constraint mentioned in section 2.7 above, "Nasals must agree in place of articulation with a following stop" applies not only within morphemes like /kæmp/ 'camp' and /wɪnd/ 'wind', but also with such kind of processes. Similarly, Dawson and Phelan (2016, p. 194) exemplify with the negative prefix 'un-' which also can be pronounced as the previous three when it fulfills the above mentioned conditions. Words like 'unbelievable', 'unstable', and 'unclear' are often articulated as [ʌmbəlivəbl̩], [ʌnsteɪbl̩], and [ʌŋkli] respectively. That is, the nasal /n/ is often pronounced as a bilabial nasal when it occurs before bilabial, as an alveolar nasal before alveolar, and as a velar nasal before velar.

The last and the most extreme type of local assimilation is known as **complete assimilation**; two neighbouring sounds become identical (Fasold and Linton, 2006, p. 45; Zsiga, 2013, p. 235). In English, for example the negative prefix 'in-' undergoes complete assimilation before [l] or [r] as in irregular the [n] is assimilated with the first sound of base word to become [r] and illegal the [n] is also assimilated with the first sound to become [l]. In Arabic, on the other hand, this sort of local assimilation is implemented with /l/, so the definite prefix [ʔæl] which is only realised with a final alveolar lateral approximant before the words that start with the 'moon letters' (الحروف القمرية). Before the 'sun letters' الحروف (الشمسية, however, represented by [ʔæʃ-ʃams] 'الشمس' means 'the sun', lateral approximant assimilates identical feature(s) with the following consonant. The following list is summarised along with example from Zsiga (2013, p. 236) to illustrates the 'sun letters' and the 'moon letters'. Hence, the former is where the complete assimilation takes place.

a) 'Sun letters' الحروف الشمسية

| Letter | Arabic Word | Transcription | English Meaning |
|---|---|---|---|
| 1. ت | التجارة | ʔat-tɪdʒaːrh | the commerce |
| 2. ث | الثقافة | ʔaθ-θaqaːfh | the culture |
| 3. د | الدين | ʔad-diːn | the religion |
| 4. ذ | الذهب | ʔað-ðahab | the gold |
| 5. ر | الرب | ʔar-rab | the lord |
| 6. ز | الزهور | ʔaz-zuhuːr | the flowers |
| 7. س | السيف | ʔas-seɪf | the sword |
| 8. ش | الشمس | ʔaʃ-ʃams | the sun |
| 9. ص | الصدر | ʔasˤ-sˤʌdr | the chest |
| 10. ض | الضفدع | ʔadˤ-dˤəfdɪʕ | the frog |

| Letter | Arabic Word | Transcription | English Meaning |
|---|---|---|---|
| 11.ط | الطبيب | ʔatˤ-tˤabi:b | the doctor |
| 12.ظ | الظلم | ʔað�̩-ð̩ˤʊlm | the injustice |
| 13.ل | الليل | ʔal-leɪl | the night |
| 14.ن | النور | ʔan-nu:r | the light |

b) 'Moon letters' الحروف القمرية

| Letter | Arabic Word | Transcription | English Meaning |
|---|---|---|---|
| 1. أ | الأسد | the lion | ʔal-asad |
| 2. ب | البدوي | the Bedouin | ʔal-badawi |
| 3. ج | الجمال | the beauty | ʔal-dʒamal |
| 4. ح | الحظ | the luck | ʔal-ħaʒ |
| 5. خ | الخردل | the mustard | ʔal-xardal |
| 6. ع | العين | the eye | ʔal-ʕain |
| 7. غ | الغرب | the west | ʔal-ɣarb |
| 8. ف | الفلفل | the pepper | ʔal-filfil |
| 9. ق | القمر | the moon | ʔal-qamar |
| 10.ك | الكنز | the treasure | ʔal-kanz |
| 11.م | المركز | the center | ʔal-markaz |
| 12.هـ | الهندسة | the engineering | ʔal-handash |
| 13.و | الوزارة | the ministry | ʔal-wiza:rh |
| 14.ي | اليوم | the day | ʔal-jawm |

Local assimilation with its different sorts it is assumed that it is very common due to its articulatory, perceptual, and processing requirements (Zsiga, 2013, p. 236). These three reasons can be more clarified as for the former it can be difficult to swiftly switch positions as it is impossible to do so immediately. Therefore, for the speaker it is easier to maintain in the same situation across neighbouring

articulations than switching back and forth from voiced to voiceless and from nasal to oral. Secondly, coarticulation between segments can steer to a wrong perception. For example, if /s/ is articulated along with the high tongue of a following /i/ or /j/, it might sound like /ʃ/. Finally, word distinction can be fastened when there are fewer decisions in the speech process to be to identify a word.

So far, this section discusses the local assimilation which causes the sounds to become similar or identical to the adjacent (preceding or following) ones. However, long-distances assimilation, which is the second sort of this rules, also exist, and its most common type is referred to as **harmony** or **vowel harmony**. Long-distance assimilation usually occurs when two vowel sounds harmonise or agree with the neighbouring one in some phonetic properties, even though they are not immediately adjacent. This process is commonly used in Turkish which obliges its words that consist of vowel suffix to match with the root word's vowel (all front or all back, and all rounded or all unrounded) (Fasold and Linton, 2006, p. 45; Zsiga, 2013, p. 237). For instance, in Turkish, depending on the vowel's property that precedes the syllable the suffix meaning 'of' has different allomorphs; [**i**p-**i**n] 'of the rope', [pul-**u**n] 'of the stamp' (ibid.). In these two examples, the front vowel (in the former) and the back vowel (in the latter) assimilate with the preceding syllable's vowel, even though they are intervened by a consonant. As it is obvious that assimilation is across-linguistic process, it referred by Rowe and Levine as an **obligatory phonological process** in which most speakers (native/non-native) of a specific language apply to make a sequence of sounds easier to pronounce and perceive (2015, p. 75).

## 2.8.2 Coalescence

Closely related to assimilation, but not identical, coalescence occurs when two sounds combine into one, in which the combined sound displays the property of the adjacent (following) one. This rule is implemented in Indonesian (and other related languages) with a process termed as **nasal fusion** in which nasal plus voiceless stop merges into one nasal sound that has the place of articulation of the stop (Zsiga, 2013, p. 238). Example a, b and c below show consonant coalescence in Indonesian. Hence, 'N' indicates to an undetermined nasal place of articulation.

a.  mə**N** + **p**ilih    →    mə**mi**lih 'to choose'
b.  mə**N** + **t**ulis    →    mə**n**ulis 'to write'
c.  mə**N** + **k**asih    →    mə**ŋ**asih 'to give'

coalescence also exists in vowels, in which the adjacement of high and low vowel results in a mid vowel with backness and roundness features of the second vowel (ibid.). Examples d, e, f, and g below show vowel coalescence in South African language called Xhosa.

d.  w**a** + **i**nkosi    →    w**e**nkosi 'of the chiefs'
e.  w**a** + **u**mfazi    →    w**o**mfazi 'of the woman'
f.  n**a** + **u**m + ntu    →    n**o**mntu 'with the person'
g.  n**a** + **i**mpendulo →    n**e**mpendulo 'with the answer'

## 2.8.3 Dissimilation

The opposite of assimilation - which causes segments to become more similar – is dissimilation (feature changing) that causes a segment to change some of its property and becomes less similar to the other one. Apparently, two significances arise in this process; a) is to ease the pronunciation, when two similar, but not

exactly the same, sounds adjoin, it is difficult to be articulated correctly, b) is to help the addressee to recognise that there are two sounds, not only one. Zsiga states that the same as assimilation but with much fewer examples, dissimilation can also be local as well as long-distance (2013, p. 238). For example, in fast speech in Greek, when a stop is followed by another stop the former is changed into fricative as in /epta/ 'seven' becomes /efta/ (Dawson and Phelan, 2016, p. 196). In ancient Greek the word [sxolio] 'school' has two neighbouring voiceless fricatives which in Modren Greek becomes [skolio] with a string of fricative-stop instead (Fasold and Linton, 2006, pp. 45-46). Another example for local dissimilation is found in Llogoori (spoken in Kenya) in which all nouns take a prefix depending on their class (Llogoori has 20 noun classes) and the initial sound (Zsiga, 2013, p. 239). For instance, the prefix of the eleventh one is pronounced [ru] before consonant-initial nouns as in [ru-ba:ho] and [rw] before vowel-initial nouns as in [rw-i:ga]. Similarly, the prefix of the first class alternate between [mu] before consonant-initial nouns as in [mu- ða:ði] 'boy' and [mw] before vowel-initial nouns as in [mw-a:na] 'child' (ibid.).

Long-distance dissimilation, on the other hand, is found in Latin. The Latin adjectival suffix [-alis] is changed into [-aris] if the stem of the word consists of [l] (ibid.). One exception imposes for this process, when the two lateral approximants are intervened by [r]; the dissimilation process is not applied (ibid.). The following three lists as adapted from Zsiga show dissimilated, un-dissimilated, and exceptional adjectives (2013, p. 239).

| **Dissimilated** | **Un-dissimilated** | **Exceptional** |
| --- | --- | --- |
| **l**un-a**r**is | nav-a**l**is | flo**r**-alis |
| so**l**-a**r**is | tot-a**l**is | litto**r**-alis |
| mi**l**it-a**r**is | coron-a**l**is | sepulch**r**-alis |

ste**ll**-aris          reg-a**l**is          late**r**-alis

popu**l**-a**r**is          espiscop-a**l**is

## 2.8.4 Insertion

Another simplification process is insertion and phonologists term it as **epenthesis**. Despite being less common processes as compared with the previous ones, insertion and the following deletion are the most important processes for this study. Insertion occurs when a segment/sound is inserted to the phonetic form of the word that does not exist in the phonemic level. An example for this kind of rule in English is the insertion of voiceless vowel between a nasal consonant and voiceless fricative (Dawson and Phelan, 2016, p. 197; Zsiga, 2013, p. 242). In this case the epenthetic voiceless stop breaks up a string of nasal consonant followed by voiceless fricative and takes the place of articulation of the nasal consonant (ibid.). Thus, for instance, the epenthetic voiceless stop may apply to the words /sʌ**mθ**ɪŋ/ 'something' → [sʌ**mpθ**ɪŋ], /hæ**ms**tə(r)/ 'hamster' → [hæ**mps**tə(r)], /te**ns**/ 'tense' → [tʰe**nts**], /dæ**ns**/ 'dance' → [dæ**nts**], and /stre**ŋθ/ '**strength' → [str**ŋkθ**].

Epenthesis is usually closely related to syllable structure when the inserted segment is a vowel. One of the most common example of epenthesis in English is, when the regular plural suffix is attached to a noun ending in sibilants, the front high vowel /i/ is inserted to break up the two fricatives as in /dresɪz/ dresses (Fromkin, Rodman, and Hyams, 2014, p. 247). Another example of vowel epenthesis is found in Yowlumne (spoken in California, USA), in which a high vowel is inserted to break up the string of three consonants which Yowlumne phonotactics never allows; /paʔtmi/ becomes [paʔitmi] (Fasold and Linton, 2006, p. 46).

**2.8.5 Deletion**

In reverse to insertion – which inserts a segment to the idealized form of the word – deletion also known as **elision** eliminates a sound which is part of the underlying form of the word. Considering English phonotactic constraints, the Greek word 'pneumonia' undergoes through this process before it becomes an English word. In this word the initial consonant is deleted because it violates English two ICCs (see section 2.7.4 above for ICCs constraints) that never allows stop plus nasal sequence in initial position (Collins and Mees, 2013, p. 79). In English, again, words with three-medial-consonants are usually pronounced by eliminating the second consonant; 'desktop' and 'grandmother' are pronounced as [destɒp] instead of /desktɒp/ and [grænmʌðə] instead of /grænmʌðə(r)/ respectively (Fasold and Linton, 2006, p. 46; Zsiga, 2013, p. 243). The [n] in the latter may then assimilate to the adjacent sound and becomes [m], resulting in [græmmʌðə] (see section 2.8.1 above for assimilation) (Fasold and Linton, 2006, p. 46).

Another example of deletion is found in Lardil (spoken in Australia) which deletes final vowel from a word that consists of three or more syllables, thus [yalulu] 'flame' becomes [yalul] (ibid.). But sometimes, as Fasold and Linton clarify this process may be expanded to delete three segments at once 2006, p. 46). In this case, when a Lardil word ends in at least with one consonant that must be articulated with tip of the tongue, the last three segments are eliminated as in [tʃumputʃu**mpu**] is pronounced not *[tʃumputʃu**mp**], with final [mp], but [tʃumputʃu], by eliminating the three final segments (ibid.). Similarly, Tagalog/Philippines deletes the second vowel of a verb when vowel-initial suffix is attached to the root of the verb which usually has a primary shape of CVC**V**C sequence (Zsiga, 2013, p. 243). The list below is adapted from Zsiga shows vowel deletion in Tagalog (ibid.). Hence, the last two forms undergo two processes, in

which the first process (deletion) causes the nasal and the stop consonants to become adjacent and set the stage for the second process of assimilation. Thus, The [n] in the last two examples assimilate with the velar stop [g] and the bilabial stop [m] and the nasal sound takes their place of articulation, so /banigin/ and /banigan/ 'mat' becomes not only /bangin/ and /bangan/ by deleting the second vowel of the verbs, but [baŋgin] and [baŋgan] by assimilating the [n] with the place of the [g] which results in [ŋ] and /ganapin/ and /ganapan/ 'fulfill' becomes not only /ganpin/ and /ganpan/ again, by deleting the second vowel of the verbs, but [gampin] and [gampan] by assimilating the [n] with the place of the [p] which results in [m] (see section 2.8.1 above for assimilation) (ibid.).

| Verb Root | Suffixed with -in | Suffixed with -an | Meaning |
|---|---|---|---|
| bukas | buks-in | buks-an | open |
| kapit | kapt-in | kapt-an | embrace |
| tubos | tubs-in | tubs-an | redeem |
| damit | damt-in | damt-an | fulfill |
| putol | putl-in | putl-an | cut |
| banig | baŋg-in | baŋg-an | mat |
| Ganap | gamp-in | gamp-an | fulfill |

## 2.8.6 Metathesis

Metathesis simply means 'changing places', in phonology it causes two sounds to switch their orders. For instance, in the past, metathesis occurs in /r/ + vowel sequence, the English words 'horse' and 'bird' are used to be pronounced as [hros] and [bridde] respectively (Fasold and Linton, 2006, p. 46; Delahunty and Garvey, 2010, p.114). Another example is found in Hanunoo (the Philippines). Similarly, but not exactly, as its neighbouring language Tagalog, mentioned in section 2.8.5

above, Hanunoo has a medial vowel deletion process in which the high back vowel /u/ is eliminated when the numeral adverb prefix is added to an ordinal number (Zsiga, 2013, pp. 244-245). Example (a) below shows Hanunoo words without alternation, and (b) shows words with /u/ deletion. Hence, Hanunoo's deletion targets only the high back vowel.

a) Without alternation
   lima 'five' ka-lima 'five times'
   pitu 'seven' ka-pitu 'seven times'
b) With /u/ deletion
   d**u**wa 'two' ka-dwa 'twice
   t**u**lu 'three' ka-tlu 'three times

The /u/ deletion, mentioned above, causes the numeral adverb prefix /ka/ create a two-consonant sequence that sets the stage for metathesis when the first consonant is glottal stop as in example (c) below (ibid., p. 245).

c) With /u/ deletion and metathesis
   **ʔus**a 'one ka-**sʔ**aa 'once'
   **ʔup**at 'four' ka-**pʔ**at 'four times'
   **ʔun**um 'six' ka-**nʔ**um 'six times'

In Leti (Austronesian language), to avoid three consonant cluster, they switch the order of the vowel and consonant in the first word when the second word starts with two consonants (Dawson and Phelan, 2016, p. 198). Applying this alternation, /danat + kviali/ 'millipede' becomes [dantakviali], and /ukar + ppalu/ 'thumb' becomes [ukrappalu]. On the other hand, /ukar + lavan/ does not undergo metathesis, because the second word does not have two consonants, so it remains as it is and pronounced as [ukarlavan] (ibid.).

## 2.8.7 Weakening and Strengthening

Weakening, also known as **lenition** causes a sound to become weaker, more open, or softer. In Spanish, for instance, the voiced stops /b, d, g/ become voiced fricatives /β, ð, ɣ/ (Fasold and Linton, 2006, p. 46; Zsiga, 2013, p. 240). A similar process is found in Florentine Italian. In reverse to the Spanish voiced stops that become voiced fricatives, in Florentine Italian the voiceless stops are sound that alternate with voiceless fricatives when they are intervocalic (Zsiga, 2013, p. 240; Oostendorp, et al., 2011, p. 1925). The following examples illustrate lenition in Florentine Italian when the definite article /la/ precedes voiceless stops.

    a. [**k**aza]  → [la **x**aza] 'the house'

    b. [**t**orta]  → [la **θ**orta] 'the cake'

    c. [**p**alla]  → [la **ɸ**alla] 'the ball'

Strengthening the opposite alternation of weakening which makes sounds weaker is also called **fortition**. Fortition makes sound more constricted or stronger. One common example of fortition is post-nasal hardening found in Setswana (spoken in South Africa) and in Kikuyu (spoken in East Africa) whereby fricatives in Setswana change into stops or affricate and in Kikuyu are changed into stops when they are preceded by nasals (Fasold and Linton, 2006, p. 46; Zsiga, 2013, p. 240; Oostendorp, et al., 2011, p. 1925).

    a. Post-nasal hardening in Setswana

        [**s**upa] 'point at'  → [n-**ts**$^h$upa] 'point at me'

        [**ʃ**apa] 'hit'        → [ɲ-**ʧ**$^h$apa] 'hit me'

        [**x**apa] 'capture'  → [ŋ-**kx**$^h$apa] 'capture me'

    b. Post-nasal hardening in Kikuyu

[**β**ur-a] 'lop off' [m-**b**ur-eetɛ]

[**r**eh-a] 'pay'　　[n-**d**eh-eetɛ]

[**ɣ**or-a] 'buy'　　[ŋ-**g**or-eetɛ]

Paradoxically, as asserted by McMahon, (2002, p. 47) these rules are not rules with the everyday used meaning of that word; they are neither regulations which spell out what must happen. Rather, they are formal descriptions of what does happen for a speaker of a certain variety of a particular language at a specific time. Moreover, he clarifies that some phonological rules may also state what sometimes happen, depending on issues outside the sounds and the sound system of the language together (ibid.).

## 2.9 Factors Affecting L2 Pronunciation Learning

The degree of pronunciation accuracy that L2 learners endeavour to achieve is strongly influenced by many factors; including age, native language, amount of exposure, etc. (Lane, 2010, p. 4). Many of these factors such as age and native language which prevent ESL learners from attaining a native-like pronunciation are beyond ESL instructors and learners' control.

### 2.9.1 The Age Factor

The age of the learner plays one of the most important factors in having a native-like pronunciation. One of the widely accepted observations made by people in the area of L2 learning is that adult L2 learners almost have always a foreign accent in their pronunciation while child L2 learners attain native-like accent (Collins and Mees, 2013, p. 258). It is also commonly assumed that if someone has a native-like pronunciation in an L2, they probably start learning it as children. Conversely, if a person starts to learn an L2 in their adulthood, they will never attain a native-like

accent, although their grammar and vocabulary, for example, are undistinguishable from those of the native speakers (Kenworthy, 1987, p. 4).

Lane (2010, pp. 4-5) discusses the effect of age in attaining a native-like pronunciation from a social-psychological point of view which offer some differences between adults and children. Adults L2 learners are assumed to have a deeper, strong and untouchable connection with their culture than children which willingly or unwillingly prevent adults from fully mastering the sound and sound pattern of the new language or culture. Another explanation of the age effect is taken from a cognitive point of view which indicates that adults' cognitive abilities are less effective than the more natural abilities of children in learning a new language's pronunciation (ibid., p. 5).

## 2.9.2 The Native Language

A central issue in L2 learning as proposed by Pennington and Rogerson-Revell (2019, p. 75) is the process of transferring a prior learnt knowledge to the subsequent knowledge; learning a second language on the basis of the native language. The sound and sound system (consonant, vowel, consonant cluster, stress, etc.) of the learners' native language affects not only ESL learners' ability to produce English sounds but also their ability to hear it. To put it very crudely, whenever there are differences (apart from their amount) between the native language and L2, learners will face difficulties in the pronunciation of the L2 (Kenworthy, 1987, p. 4). Thus, almost all L2 learners who have a foreign accent it is undoubtedly determined by their native language and recognised by almost all native speakers (Collins and Mees, 2013, p. 259). Therefore, this foreign accent is a crucial indicator which demonstrates the differences between the sound and sound system of the learners' native language which are transformed into the L2.

Avery and Ehrlich (1992, p. xv) conclude that the factor of the native language influences the pronunciation of ESL learners in three ways. Firstly, the influence of the native language arises when ESL learners encounter sounds that are not part of their native language sound inventory. Secondly, this influence arises because of the phonotactic system of both languages (L1 and L2) are different which is the backbone of the present study. Thirdly, the stress and intonation patterns which to large extent determine the overall rhythm and melody of a language, can easily be transformed from the native language into the L2.

### 2.9.3 Amount of Exposure

Another factor of pronunciation learning is the amount of exposure to L2 learners receive. That is, learners who spend, for example, two years in an English-speaking country/environment have better English pronunciation than those who only spend two months (Lane, 2010, p. 5). In other words, if the learner is surrounded by English on a constant base, it should undoubtedly affect their pronunciation skill positively. Conversely, if the learner is not surrounded by English, they will not get such advantage.

It is worthy to mention that someone cannot simply talk in terms of residency because many learners live in an English-speaking country, but spend most of the time in a non-English-speaking environment, attain no accurate pronunciation. Conversely, many learners live in a non-English-speaking country but use English in their lives (Kenworthy, 1987, p. 6). The exposure to the L2 is not the only matter that affects pronunciation learning but more broadly is how L2 learners benefit from the opportunity they get to listen and use the L2 in their daily lives. Various studies have compared the pronunciation accuracy of people living in an

English-speaking countries and those who aren't, they conclude that amount of exposure is not a necessary factor but a contributory one to these factors (ibid.).

### 2.9.4 Phonetic Ability

It is commonly assumed that some ESL learners have a better ear for foreign language perception than others. That is, the person who learns the phonetic of the TL correctly will have a native-like pronunciation. Aptitude for oral mimicry, phonetic coding ability and auditory discrimination ability are terms used for this skill (Kenworthy, 1987, p. 6). It is worth noting that every human being, unless hearing-impaired, has this basic ability of because if they did not have it they would never ever learn the sound of their native language (ibid., p. 7).

Researchers in the area of pronunciation design tests to measure this ability and they found that some people have a high ability of discriminating two sounds and are able to mimic sounds more accurately than others (ibid., p. 6). To put it very crudely, L2 learners are classified into poor and good discriminators according to the benefit they get from different types of training. Kenworthy (1987, p. 7) indicates that learners with good phonetic abilities benefit from pronunciation drills. On the other hand, those who have poor phonetic abilities do not seem to benefit from those drills very much which in fact affect them negatively in their endeavour to attain a native-like pronunciation.

### 2.9.5 Personality

Personality characteristics are other factors which affect learners to acquire the sound and sound system of an L2. Extrovert, sociable and confident learners and those who are willing to take risk have an advantage over those who are introverted, unsociable, shy having a native-like pronunciation. In other words, outgoing learners are more often involved in conversations with native speakers

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which in turn offer them great opportunity to practise and hear the TL. Conversely, introverted learners who do not engage in conversations with native speakers, lack the opportunity of practice (Avery and Ehrlich 1992, p. xiv; Lane, 2010, p. 6). Therefore, it is advisable for ESL instructors to be aware of such personality characteristics which can strongly affect the progress of their learners (Avery and Ehrlich, 1992, p. xiv).

## 2.9.6 Attitude and Identity

It is reasonable to suppose that feeling and identity are strong indicators to the acquisition of accurate pronunciation of the L2. Researchers on attitude and the upcoming factor motivation in language reveal that learners who show positive feelings towards speakers of a new language tend to develop more accurate, native-like pronunciation (Kenworthy, 1987, p. 8). More than that, the degree of acquiring a perfect pronunciation depends largely on the learners' attitude towards their communication (Harmer, 2007, p. 249).

## 2.9.7 Motivation and Concern for Good Pronunciation

Learners who are concerned about their pronunciation and more motivated to have a native-like accent will be more successful than others. If learners are not motivated, no teacher can force them to learn as the proverb says "You can lead a horse to water, but you cannot make him drink" which fully depicts the process of teaching. In almost all aspects of language learning, learners who are highly willing to do well give an indicator of having achievement motivation which is the tendency to strive for success or attain a desirable goal. Conversely, if learners do not have such kind of willingness and care about their endeavour or do not see its value, undoubtedly they will not be motivated to do it well (ibid.).

It is clear that the main source of motivation is the learners' need for learning the language. Based on this need, Gardner (1985) as cited in Pennington and Rogerson-Revell (2019, p. 94), motivation is divided into two sorts; integrative motivation in which learners reflect a desire to be accepted within the native speakers of the L2 and instrumental motivation in which learners reflect a practical desire to reach a goal. Deci and Ryan (1985), on the other hand, as cited in Pennington and Rogerson-Revell (2019, p. 94) classify motivation into two different types, intrinsic motivation which reflects the learners' interior needs, desires and satisfactions and extrinsic motivation which reflects learners' exterior consideration and restrictions.

## 2.9.8 Setting Realistic Goals

Mentioning that age, native language, amount of exposure, phonetic ability, personality, attitude and identity and motivation as factors which may prevent ESL learners from attaining a native-like accent in an L2, it is also worthy to mention that setting a realistic goal is a real asset to gradually attain a native-like pronunciation. That is, ESL instructors and learners need not to completely eradicate foreign accents. Therefore, it is advisable for ESL instructors to focus on their learners' critical errors, features of foreign accents on their learners' speech which eventually lead to incomprehensibility (Avery and Ehrlich, 1992, p. xvi). To fulfill this advice Avery and Ehrlich come up with a two-step strategy. First, ESL instructors should make their learners aware of their critical errors which lead to incomprehensibility. Secondly, ESL instructors should give their learners opportunities to practise the aspects of the L2 sound system which are crucial to produce a comprehensible speech (ibid.).

## 2.10 The Importance of Pronunciation and Its Instruction

The supreme goal of teaching/learning a language is to enable the learners to/be able to communicate in the TL. Therefore, progress in almost every aspect of language acquisition/learning depends largely on the contribution made by communication – to understand and to be understood – which can only be achieved by the cornerstone of communication 'pronunciation'. Unfortunately, many instructors are not aware of the importance of this cornerstone. These instructors pay enough attention to such areas of language as grammar, vocabulary and productive and receptive skills (Harmer, 2007, p. 248). This negligence of teaching pronunciation is attributed to many reasons as stated by Harmer (ibid.):

1. Instructors feel nervous when they deal with sounds and intonation.
2. Instructors feel that explicit pronunciation teaching make things worse.
3. Instructors think that pronunciation learning is very difficult and tedious for learners.
4. Instructors believe that learners are able to acquire perceivable accent without explicit instruction.
5. Learners believe that learning pronunciation is a waste of time.
6. The lack of high quality and suitable teaching and learning materials.
7. Lack of time to practice the pronunciation activities.

It is not only Harmer who claims the negligence Gilakjani (2011, p. 1); Hismanolglu and Hismanolglu (2011, p. 23); Celce-Murcua, Brinton and Goodwing (1996, p. 2) express that pronunciation is the least favourite language area to be taught in classes as compared to such areas of language as grammar, vocabulary and the four language learning skills.

No doubt that grammar and vocabulary are important elements of language teaching/learning, but unless speakers pronounce those elements properly, their communication will never be successful (Harmer, 2007, p. 248). It is customary that native speakers understand every speech despite its grammatical errors, if it is spoken in accurate pronunciation (ibid.). Hence, it is even obvious that every child struggles to acquire the pronunciation of their MT much earlier than its grammar.

Accordingly, Pronunciation is not only the core and essential part of communication to become skilled in, but in the best case is an area of spoken language that leads to successful communication and add an invaluable and effective worth for the daily life interaction with others (Pennington and Rogerson-Revell (2019, p. 22). It is therefore being aware of the pronunciation aspects of language can be beneficial not only to the sound production, but also to produce comprehensible and intelligible speech. Harmer (2007, p. 248) emphasises that through formal pronunciation instruction students will not only learn the different sound and sound system but also improve their communication skill.

Labov and Hanau (2011) as cited in Pennington and Rogerson-Revell (2019, pp. 159-161) in their pronunciation course based study demonstrate the value of pronunciation even for fluent English speakers which can lead to death. To show the importance of pronunciation and any unintelligible and misunderstood words can negatively affect one's communication and in the medical field can result in death which is fully depicted in their study title "Pronunciation as Life and Death: Improving the communication skills of non-native English speaking pathologists".

The study subjects are seven fluent non-native English speaking pathologists but had speech problems which are described by the researcher as fossilised or stabilised. The subjects are asked to record their specimen's report into a tape

recorder and native English speaking medical secretaries are asked to transcribe the recording. The findings reveal that 72 (2%) of the words produced in the first week tapes are unintelligible and 52 (1.4%) are considered as misunderstood by the medical secretaries. Both, the unintelligible and misunderstood words are regarded as high percentage in the medical field. The 3.4% of the incomprehensible words seems a small percentage, but in the medical field one mistake can affect a patient's health negatively. In fact, only 25% of the unintelligible and 19% the misunderstood words are purely technical words such as '*infraction*' heard as '*infection*' which can seriously affect the report information, and the remainder are non-technical words such as '*firm*' heard as '*full*'. By the end of the course, the research findings demonstrate that the course is statistical significant and the participants show a tremendous improvement in their pronunciation.

## 2.10.1 The needs of adult EFL learners to master the pronunciation of their L2

Yates and Zielinski (2009, p. 17) propose four requirements to be met for everyone who endeavours to attain a native-like accent. First and foremost, apart from being exposed to the TL, adult EFL learners need **focussed support and instruction**. It is assumed that pronunciation learning is not easy for adults as children. To that end, most adult learners cannot learn an intelligible pronunciation without focused and explicit instruction. Secondly, as in every aspect of language learning and with a great deal in pronunciation, pronunciation learning needs **time and patience**. Improvement in pronunciation never happens overnight as in learning vocabulary items for example. It needs lots of practice and through your patience you can increase its activities. Thirdly, **continuity**; to attain native-like pronunciation, learners need to practise speaking on a continuous basis. This means that intelligible accent can only be acquired through speaking continuously. The last

requirement is **awareness**. One of the factors that affect pronunciation learning is the native language of the learner (see section 2.9.2 above). Therefore, they need to be aware of their L1 and notice how the extraction of their native language accent affects positively their L2 accent.

## 2.10.2 The best method for teaching pronunciation

There is no a conclusive answer to this question. It is also known for almost all instructors, there is no a single method for teaching any aspects of language. Because learners and context vary from class to another, it is difficult if not impossible to suggest a single teaching approach. Therefore, as suggested by Yates and Zielinski (2009, pp. 19-20), there are five principles that are crucial for teaching pronunciation and should be included in any teaching approach.

Firstly, pronunciation teaching should **start from scratch**; instructors should pay attention from the first day of starting teaching the language. Early exposure to the fundamental elements of pronunciation can help learners reach to the fact that English is not a phonetic language which in turn help them to develop their grammatical as well as writing skills. Therefore, regardless of their language level (beginners or advanced), staring learning pronunciation as early as possible helps learners to take hold of pronunciation matters throughout their learning.

Secondly, instructors should **be proactive**; they should deal with pronunciation matters in advanced. Teaching pronunciation is not only about correcting errors, but rather teaching learners how to speak and avoiding those errors in advance through providing models and helping them to be aware of the sounds and sound system of English.

Thirdly, after starting from the scratch and being proactive, instructors need to **train their learners' ears and mouths**. Overcoming writing temptation is the first

step to train ears and mouths. Therefore, focusing on training learners' ears and mouths helps not only resist the temptation of writing, but it also encourages learners to have good pronunciation in spontaneous speech.

As a forth principle, instructors should entail a native speaker **model** and a plenty of **practice** time in their teaching approach. Learners should be exposed to authentic materials prepared by native speakers through listening and speaking preferably with native speakers too.

The fifth principle is to **avoid the fear of using essential technical terminology**. It is crucial for learners even those who are at their beginning to tackle pronunciation through its technical terminologies. To that end, instructors as well as learners should have a shared way to address pronunciation learning.

The researcher believes that, along with Yates and Zielinski's five principles, instructors should **be aware of their learners' L1**. As mentioned in section 2.9.2 above, the learners' L1 plays an essential role in the process of acquiring a new language's sounds and sound system. To that end, instructors should acquaint their learners the differences between their L1 and the TL. This acquaintance helps the learners to proactively avoid or decrease any L1 transfer.

## 2.11 The Concept of Error Analysis (EA)

The study at hand adopts Error Analysis (EA) theory which is coined by Stephen Pit Corder in the early 1960s. Corder claims that errors are crucial indicators for the learning process. EA is an L2 acquisition method which involves describing and classifying learners' errors to know their current knowledge of the L2 system (Hummel, 2014, p. 65). With reference to its ultimate goal, Richards and Schmidt (2010, p. 201) assert that EA studies and analyses the errors made by second

language learners in their endeavour to master the TL. More broadly, Crystal defines EA as: "a technique for identifying, classifying and systemtically interpreting the unaccepted forms produced by someone learning a foreign language, using any of the principles and procedures provided by linguistics" (2008, p. 173).

Thus EA is one of the first methods used to investigate learner language. EA is an alternative for Lado's Contrastive Analysis (CA) as Ellis asserts that:

> In the 1970s, EA supplanted Contrastive Analysis (CA), which sought to predict the errors that learners make by identifying the linguistic differences between their L1 and the target language. The underlying assumption of CA was that errors occurred primarily as a result of interference when the learner transferred native language 'habits' into the L2… CA gave way to EA as this assumption came to be challenged. Whereas CA looked at only the learner's native language and the target language (i.e. fully-formed languages), EA provides a methodology for investigating learner language. For this reason EA constitutes an appropriate starting point for the study of learner language and L2 acquisition (1994, pp. 47-48).

Language learners make errors in their course of mastering a language in both comprehension and in production (Ellis 1994, p. 47). However, comprehension errors are difficult to disclose as it is often impossible to decide the source of the linguistic errors. Therefore, EA is a de facto study of the errors that learners make in their speech and writing (Ellis and Barkhuizen 2005, p. 51).

## 2.12 The Significance of Learners' Errors

Errors are no longer considered as indications of language learning difficulties, but rather they view learners' serious attempts to systematically develop themselves. According to Corder (1967, p. 167) learners' errors are significant in three different ways: First to the instructors, in that they act to offer to the instructors how far learners have progressed and what they have not mastered. Second to the researchers, in that they provide them with evidence of how language is learnt and what strategies learners use in their discovery of the language. Third to the learner himself, in that they act as devices by which the learner discovers the rules and the systems of the target language (the last one is their most important aspect).

## 2.13 The Distinction between Error and Mistake

A significant distinction is made between errors and mistakes which are not treated the same from a linguistic viewpoint. Corder (1967, p. 167) distinguishes errors from mistakes as the former refers to deviations results from the gaps in the learners' L2 knowledge while the latter results from performance failure. More broadly, the former is defined by Brown (2007, p. 257) as "a noticeable deviation from the adult grammar of a native speaker, reflecting the interlanguage competence of the learner". The latter refers to a deviation in learner language that takes place when learners fail to perform their competence (Corder 1981, p. 10). That is error come out of the learners' linguistic competence whilst mistake from the learners' performance. Thus, any deviation from the target language norm causes a performance or competence problem (Ellis. 1994, p. 58).

## 2.14 Steps of Conducting Error Analysis

Corder (1974 as cited in Ellis, 1994, p. 48) suggests five steps in order to conduct EA in learner language as follows:

### 2.14.1 Collection of Sample of Learner Language

The first and foremost step in conducting EA is collecting a sample corpus of learner language and this provides the data for the EA (Ellis and Barkhuizen, 2005, p. 57). In collecting the data, the researcher needs to be acquainted with the nature of the corpus gathered which may affect the nature and distribution of the errors observed (ibid.). Ellis and Barkhuizen identify three kinds of factors which can influence learners' collected sample: learner, language and production (2005, pp. 57-58) (See table 2.18).

**Table 2.18** Factors to be considered in collecting samples of learner language as adopted from Ellis and Barkhuizen (2005, p. 58)

| Factors | Description |
|---|---|
| A. Learner | |
|    1.  Proficiency level  ⟶ | Elementary, intermediate or advanced |
|    2.  Other languages  ⟶ | The learner's L1, other L2s |
|    3.  Language learning background ⟶ | Instructed, naturalistic, mixed |
| B. Language | |
|    1.  Medium ⟶ | Oral or written |
|    2.  Genre  ⟶ | Conversation, narrative, essay |
|    3.  Content  ⟶ | The topic of the discourse |
| C. Production | |
|    1.  Unplanned  ⟶ | The discourse is produced spontaneously. |

| 2. Planned ──────────────▶ | The discourse is produced after planning or under conditions that allow for careful online planning. |
| --- | --- |

Corder (1973 as cited in Ellis, 1994, p. 50) distinguishes two types of elicitation by which the data of learner language can be collected. First clinical elicitation refers to the act of getting the respondent to produce data of any sort of language, for example, through unstructured interview or simply by asking learners to write a piece of composition. The second one is experimental elicitation which refers to the data obtained by using special tool containing the linguistic features that the researcher needs to investigate.

## 2.14.2 Identification of Errors

In accordance with the distinction between errors and mistakes made above (see section 2.13) and after the sample of learner language is gathered, the errors in the sample need to be identified through a direct comparison between what the learner produces and what the native speaker of the language would typically produce in the same context (Ellis and Barkhuizen, 2005, p. 58). In other words, this step determines which sample of the learners' language deviate from the TL. To gain a proper comparison between these two productions certain basic procedures must be followed:

1. Assemble a reconstruction of the same sample collected from learner language with its counterpart of the native speaker.
2. Suppose that the production of the learner is erroneous and eliminate the correct items which are compared with the native speaker's sample.
3. Determine which item(s) of the learner's production differs from the reconstructed version.

Once these procedures are carried out, the researcher also needs to distinguish between errors which reflect gaps in knowledge and mistakes which reflect lapses in performance (Ellis, 1997, p. 17) (See section 2.13 above).

## 2.14.3 Description of Errors

When all errors are identified, they need to be described and classified into language levels (Ellis, 1997, p. 18). To assert this Corder (1974, p. 128 as cited in Ellis and Barkhuizen, 2005, p. 60) writes "the description is essentially a comparative process, the data being the original erroneous utterances and the reconstructed utterance. For example, some researchers choose to describe learner errors according to the deviated level of language (phonological, morphological, syntactic, etc.) while others opt to examine specific linguistic categories such as pronunciation, consonant clusters, auxiliary system, passive and negative constructions, articles, prepositions, etc. (Hummel, 2014, p. 66). In this case the researcher gathers all the errors related to pronunciation for instance, and then identifies the different types of pronunciation errors from the collected data, errors of consonant cluster pronunciation for example. Another way is to try to identify how far the learners' production differs from the reconstructed version of the native speaker (Ellis, 1997, p. 18).

Dulay, Burt and Krashen (1982, p. 150) suggests that there are four basic ways in which learners modify the target language:

1. The act of omission (for example, omission of consonant in a syllable of consonant clusters as in /sɪks/ instead of /sɪksə/ for sixth).
2. The act of addition (i.e. adding short vowel in initial three consonant clusters as in /əsplæʃ/ or /ɪsplæʃ/ instead of /splæʃ/).

3. The act of misinformation (i.e. the use of /b/ for /p/ as in /bleɪ/ instead of /pleɪ/ for play).

4. The act of misordering (i.e. the incorrect placement of morpheme or a group of morphemes in an utterance, though it is not applicable in this study, as in 'What she is doing? Instead of What is she doing?'.

## 2.14.4 Explanation of Errors

Once the data is collected, identified and described, the errors in the data have to be explained. Explanation is the most important stage according to the view point of second language acquisition (SLA) research in EA. This stage involves deciding the source of error(s) learners make and it attempts to establish the responsible processes of L2 acquisition (Ellis, 1994, p. 57). One of the main sources of error is a psycholinguistic source such as transfer and intralingual. It is worth noting that along with the psycholinguistic source, there are sociolinguistic, epistemic and discourse sources. The sociolinguistic source involves learner's problems in adjusting their language to the social context. The epistemic source of errors arises from the gap of the learners' universal knowledge while the latter is concerned with the learners' problems of producing incoherent texts. Generally speaking, psycholinguistic source of error outstands as the main and most effective in SLA research. Abbott (1980, p. 124 as cited in Ellis, 1994, p. 58) states that EA aims to provide a psycholinguistic explanation of the learner's errors. Richards (1970, p. 3), on the other hand, states three sources of errors:

1. Interlingual or interference errors (the use of the learner's L1).
2. Intralingual errors (the application of the L2 rules in an inappropriate context).
3. Developmental errors (the learner's attempts to construct the TL system).

The distinction between errors and mistakes which is discussed above also shows the interdependence of these two steps (identification and explanation of errors) in EA.

### 2.14.5 Evaluation of Errors

So far the above mentioned steps involved examining errors from the learners' point of view, whereas this last step is concerned with anaylsing the effect those errors have on the address, i.e. native speakers' comprehension of the learners' production. Therefore, EA is not only coined to help learners learn an L2, it is also important to evaluate their errors. This involves deciding the gravity of different errors with a view to determine which errors need remedial instruction (Ellis and Barkhuizen, 2005, p. 67). Then they identify four steps to evaluate errors:

1. Choose the errors to be evaluated.
2. Determine the standard on which the errors are to be judged.
3. Assemble the error evaluation tool.
4. Select the judges.

## 2.15 Review of Related Previous Studies

To have a comprehensive insight and clear image of the problem at hand, this section reviews some studies carried out in the context of phonology and more particularly works conducted in the area of English phonotactics of ICCs and FCCs on EFL Arab and non-Arab students.

**Darcy and Thomas** in an article published at Cambridge University Press (2019, pp. 1, 5-6 and 13-14) carry out a study assessing perceptual epenthesis on the mental lexicon of second language learners. This study is conducted to examine how the sound sequences permitted in one's L1 influence the way words from the

L2 are represented and accessed in the mental lexicon. More specifically, this study aims to investigate the potential consequences of perceptual repairs in the mental lexicon for Korean learners of English. To achieve this, they hypothesise that Korean learners of English might store English words with spurious vowels in their mental lexicon, as a result of perceptual epenthesis during word learning and predicted that if epenthesised vowels were indeed lexically represented, Korean L2 learners would accept nonwords containing epenthetic vowels (/bʊluː/ for /bluː/ 'blue') as real English words more often than English listeners.

Focusing on all second language learners, Darcy and Thomas believe that whenever L2 leaners need to pronounce a foreign word containing sound sequences that do not exist in their L1, they often modify these sequences in order to conform to those permitted in their L1. As a general example for this, they exemplify with English speaker pronouncing foreign words as follows:

> … when English speakers need to talk about the capital city of Georgia (Tbilisi), or about a city on the Baltic coast in Poland (Gda´nsk), they tend to insert a vowel and pronounce /təˈbilisi/ and /gəˈdænsk/, because /tb/ and /gd/ are not permitted at the beginning of English words.

Using quantitative method of data analysis, they test their hypotheses with an auditory lexical decision task, where participants have to indicate by a button press whether an item is a real English word or not. This task consists of 30 common English words containing onset clusters, which are modified to create 30 pairs of experimental nonwords: thirty test items containing /ʊ/, which is similar to the Korean epenthetic vowel for onset clusters (for instance, /bʊluː/ or /pʊleɪ/, and thirty control items, which contain the vowel /ɪ/ (for instance /bɪluː/ or /pɪleɪ/). A total of 39 participants (21 L1 English speakers and 18 L1 Korean learners of

English) take part in the study. The native speakers of English did not know any Korean, but five participants knew a second language (Spanish), acquired after the age of 11 (*M* = 12.4). The native speakers of Korean are proficient in English at an intermediate to advanced level.

The findings reveal that Korean listeners experience more difficulties when they had to reject nonwords containing the epenthetic vowel (e.g., /bʊluː/), but were overall more similar to native listeners when rejecting nonwords containing the control vowel (e.g., /bɪluː). This result indicates that L2 participants do not accept nonwords containing any additional vowel but rather a nonword with [ʊ] successfully activates their phonolexical representation. It also concludes that the English phonotactic constraints licensing ICCs are not yet fully acquired by the majority of the Korean participants, and that, to a substantial extent, the L1 phonotactic grammar shapes phonolexical representations for well-known English words.

**Al-Gamal's** study at the Journal of Advanced Linguistic Studies (2018, pp. 38 and 58-9) reports the effect of explicit teaching of English phonotactic constraints on Yemeni EFL undergraduates' achievement in double onset and double coda CCs. This study aims to examine the effectiveness of explicit teaching in raising the awareness of such kinds of constraints. The participants of this study are divided into two groups; 5 native and 76 non-native speakers of English. The non-native group is further divided into 38 control group and 38 experimental one. The non-native groups are third-year students from the Department of English Language, Faculty of Education at Thamar University in Yemen. The three groups are pre-tested using double onset and coda tasks designed by the researcher in a form of a questionnaire. The non-native group, however, is post-tested within 8 weeks after

receiving training consisting of explicit teaching of relevant phonotactic constraints.

The pre-test results reveal that Yemeni non-native speakers showed weak performance as compared to their native counterparts. He attributes this weak performance to the effect arises by the phonotactic rules of their L1 and are not exposed to explicit training on double onset and coda clusters either at school or university level. It is also evident that, based on the findings, teaching phonotactic constraints explicitly to Yemeni EFL learners is effective in which the non-native experimental group gains a significant achievement in both double onset and coda CCs than their counterpart non-native control group and equalised with the native control group.

Based on the research findings, Al-Gamal recommends that teaching phonotactic constraints explicitly can be applied at Thamar University and other universities in Yemen and in the Arab World as the results of the current study reveal that with appropriate training, EFL learners can improve and make the learning of certain English-specific phonotactic constraints better and faster.

**Keshavarz** in an article at the Iranian Journal of Language Teaching Research (2017, pp. 1, 5 and 10) sets out a study to investigate difficulties of syllabification errors of Kurdish EFL learners in the pronunciation. The aim of this study is mainly to explore the difficulties of adult Kurdish EFL learners in the pronunciation of English CCs and to provide some constructive recommendations.

The study adopts a quantitative method. The data for this study is collected through classroom observation and a pronunciation test. The test consists of a short paragraph; a set of individual sentences, and a word list (or isolated words)

containing CCs. 18 male Iraqi Kurdish EFL learners, studying at a private university in Northern Cyprus, volunteer to participate in this study.

The findings show discrepancies in the participants' pronunciation of CCs, i.e., while they do not exhibit any problem in the pronunciation of initial CCs, most of them employed vocalic epenthesis, as a repair strategy, in word final position to facilitate the pronunciation of complex clusters of the TL. Keshavarz attributes these mispronunciations to be mainly due to the influence of the MT as Kurdish phonotactics does not allow certain CCs in word final position. Other factors such as lack of sufficient exposure to the TL should also be acknowledged. Moreover, since all of the participants are adult EFL learners it is safe to assume that their errors in the use of English CCs have been fossilized. To that end, he recommends that pronunciation errors should be dealt with during early stages of L2 acquisition, when students are younger and have more vocal tract flexibility for acquiring the pronunciation of the TL and to prevent fossilisation.

**Gashaw** in an article at the Abyssinia Journal of Business and Social Sciences (2016, p. 1 and 3) conducts a study on the perception of English CCs by Ethiopian learners. This study is an attempt to examine the perception of Amharic speaking Ethiopian EFL learners while listening to English words with CCs and to come up with some practical recommendations to improve the perception of English CCs.

The researcher utilises quantitative and qualitative approaches to analyse the data. The study uses a dictation task to collect the data in which audio recorded speeches of target words by English native speakers are presented for transcription. These recordings are taken from O'Connor (1980) and Roach (1991). They include nine words purposely selected to demonstrate the different phonological patterns of

English CCs. Five (two females and three males) EFL learners speaking Amharic as first language participate in this study by completing the dictation task.

The findings reveal that most of the learners' transcriptions are found to be semantically different as compared to the original ones. It also demonstrates that the learners have perception problem of consonant cluster of all kinds at all positions both at word and phrase levels especially with clusters comprised of dental fricatives which are lacking in the learners MT. Moreover, the results show that three and four CCs are critical for the learners particularly when they are presented across words in connected speech.

Emphasizing the importance of CCs, Gashaw comes out with a constructive recommendation for instructors to make learners familiar to English CCs so that learners improve comprehension abilities of such clusters.

In a relatively surprising context; Nigerian, **Oluomachi** in an unpublished MA dissertation (2016, p. 3) investigates phonotactic constraints in the pronunciation pattern of Igbo-English bilingual students. Emphasizing the significance of phonotactic constraints on pronunciation, Oluomachi sheds a light on the crucial role of CCs on the performance of EFL leaners.

This study adopts a descriptive survey design to investigate the phonological phonotactic patterns of the permissible CCs in both English and Igbo languages and their influence on the Igbo speakers of English. A mixed method is used to analyse the data of the study. Two Labovian models of passage and word list reading tests are utilised as data collection tools. The participants of this study are 97 secondary school students from three secondary schools in Owerri municipal council of Imo State.

The findings of this study reveal that participants insert vowels and delete segments (sounds) in English CCs so as to harmonize English words with Igbo phonotactic structure which are lacked in their MT CCs inventory. It also shows that phonological phonotactic structures are language specific which may sometimes interact with other languages' structure or violated by second language learners.

Based on these findings, Oluomachi recommends that curriculum designers should include phonotactic learning in school curriculum so as to familiarise students with the constraints of the TL which eventually leads to self-assessment. She also recommends that instructors need to pay attention to the learners' MT and highlight the areas that are problematic in their endeavour to acquire the TL.

**Mbha and David** in an article at the Innovare Journal of Social Sciences (2014, pp. 10 and 15) carry out a constraint based explanatory study of Tiv (spoken by Tiv people of Nigeria) learners of English. The study, in particular, presents explanation on the likely pronunciation errors evident to Tiv learners of English phonotactics. Emphasising on the ultimate goal of almost all EFL leaners, Mbha and David highlight that:

> The ultimate goal of most second language learners is to attain native like fluency. They want to be indistinguishable from native speakers. However, for many learners, this dream has remained a dream especially in the area of pronunciation as native speakers usually identify individuals as non-native speakers because of their accents.

The researchers adopt a descriptive method to note the possible constraints the Tiv learners of English as L2 encounter. The findings show that Tiv speakers of the English realise phonotactics of English words differently. It also demonstrates that

they violate the phonotactic rules of English in realising CCs, assimilation and vowel harmony. Moreover, the study observes that the Tiv learners experience difficulties in realising English syllabic pattern with CCs; they find it difficult pronouncing it without the insertion of a vowel sound. Mbha and David as in many other EFL learner pronunciation problems of CCs attributes these difficulties to their MT.

**Al-Samawi,** in an article at the International Journal of English and Education, (2014, pp. 263, 265, 270 and 273) asserting the difficulty that Arab learners of English encounter is in pronouncing English CCs correctly and that they tend to insert an epenthetic vowel (usually a schwa) between the consonants, dividing the single syllable into two syllables, as Arabic language does not permit such sequence in the initial position, conducts an empirical study to examine the effect of vowelizing English CCs with Arabic vowel points (harakaat) to improve Arab learners' pronunciation. More specifically, this study aims to investigate the effect of using Arabic vowel points (*harakaat*) on one-syllable English words of three CCs in initial and final positions. Harakaat are diacritics or signs such as *fatḥah;* a flat line put over the preceding consonant to replace the short vowel /ʌ/ as in the word '*gum'* /gʌm/, *dammah;* takes the shape of coma put over the preceding consonant to indicate the movement of that consonant, as in the case of the word 'not' /nɒt/, *kasrah;* is another flat line put under the preceding consonant to replace the short vowel /ɪ/ as in 'bill' /bɪl/ and *sokoon* that takes the shape of a small circle is used over that consonant.

The study utilises a quantitative design to statistically analyse the data. The author designs four lists words to collect the data; two with *harakaat* in initial and final positions and two without. 40 students majoring in English language at English

Language Teaching Education programme at the College of Education, Al Ain University. Each participant is recorded while reading the words of the two lists.

The findings show significant differences between the mean of words with harakaat and the mean of words without harakaat, favoring writing words with Arabic harakaat over and under English letters for the facilitation of having intelligible pronunciation for the English CCs. It also demonstrates that writing English words with these harakaat indicates to better pronunciation of ICCs than their FCCs counterparts.

Thus, the above mentioned studies confirm the cruciality of English CCs not only for Arab students but also for so many EFL students.

## 2.16 Summary

This chapter provides a detailed description of the relationship between phonetics and phonology. It also highlights the segmental and suprasegmental features of speech sounds. In addition to that, it discusses the notion of syllable, English and Arabic structure syllable, syllable patterns in English and Arabic and the Maximal Onset Principle. Moreover, it introduces the phonotactic constraints and the phonological processes of English language. Additionally, it accounts the factors that affect pronunciation learning. Furthermore, discusses the theory of 'Error Analysis' (EA). Finally, it reviews some previous studies related to the study at hand.

# CHAPTER THREE

## Research Methodology

### 3.0 Introduction

The first two chapters of this thesis introduce a thorough and general background of the current study, and outline the theoretical framework as well as review the literature pertinent to this research; the aim of this chapter is to provide a full description of the methodology the researcher pursues in this study as follows: Firstly, the method adopts to analyse the data. Secondly, the population and sample participate in the study. Thirdly, the instrument the researcher utilises to collect the data. Fourthly, the validity and reliability of the instrument are presented. Lastly, the procedure which is followed in the process of collecting and analysing the data is discussed.

### 3.1 Method

The researcher adopts a mixed method of data analysis which stresses both small and large group of participants in order to incorporate the elements of both qualitative (using words) and quantitative (using numbers) methods and strengthen the findings of this study greater than using either qualitative or quantitative. It also adopts a descriptive analytical approach to analyse the data.

### 3.2 Population

The population of this study are university instructors and students. These instructors and students are from five universities in Khartoum, Sudan; Al-Neelain University where the researcher does his BA and MA, Sudan University of Science and Technology where the researcher does his PhD, International University of

Africa, Nahda College where the researcher teaches and Almughtaribeen University where the supervisor of this thesis works. It is also worthy to mention that the first three universities are public while the other two are private ones.

## 3.3 Sample Size

The student samples of this study are chosen from three undergraduate levels of the academic year 2019/2020 and they are all full time students major in English language. Sixty second year students are randomly selected to undertake a word-list reading test from Al-Neelain University, SUST, Nahda College and Almughtaribeen University; seven females and eight males from each one. A second test is undertaken by sixty fourth year students with the same category and number of students from the same universities. The last group of students is third year students who participated in an observation along with their instructors. The researcher attends an hour-and-a-half lecture on CCs and phonotactics at each university to conduct the observation checklist. It is advantageous to mention that all participants speak the same Sudanese colloquial Arabic as their L1 and English as an L2.

The instructors who deliver the lectures for the observation are two ESL experienced university instructors from Al-Neelain University and Nahda College and those who undertake the interview eight ESL experienced university instructors from Al-Neelain University (two), International University of Africa (one), Almughtaribeen University (two) and Nahda College (three) and their years of experience in teaching at tertiary level ranges between 3-20 years and 2-15 in teaching phonetics and phonology (see table 3.1 below). It is also worthy to mention that they are all native speakers of Arabic.

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**Table 3.1** Interviewees' experience of teaching at tertiary level and teaching phonetics and phonology

| Participant | Teaching at Tertiary Level | Teaching Phonetics and Phonology |
|---|---|---|
| Participant #1 | 10 years | 03 years |
| Participant #2 | 18 years | 15 years |
| Participant #3 | 04 years | 04 years |
| Participant #4 | 05 years | 03 years |
| Participant #5 | 07 years | 02 years |
| Participant #6 | 20 years | 04 years |
| Participant #7 | 12 years | 04 years |
| Participant #8 | 14 years | 10 years |
| **Mean** | **11 years** | **6 years** |

## 3.4 Instruments of Data Collection

The tools utilised for the data collection of this study are two tests, interview and observation checklist. This diversification of tools is basically used to complement each other and to reduce as much as possible the demerits of each instrument. Not only that but also they allow the researcher to present comprehensive findings collected from the real stakeholders of the current study; students and instructors.

### 3.4.1 Word-list Reading (Oral) Test

The first test consists of a word-list reading task. This task is comprised of twenty-four words and they are divided into two parts. The first part consists of twelve words with ICCs in three sections. The second part also consists of twelve words with FCCs in three sections, too. It is also worthy to mention that this test aims at

identifying the mastery of English phonotactics of words involving ICCs and FCCs as pronounced by Sudanese EFL undergraduates. For this test, the participants are asked to read aloud the word-list reading task.

### 3.4.2 Pseudo-word (Written) Test

The second test consists of fifty pseudo-words which are formed by taking into account the violation and conformity of English phonotactic system. Among the fifty words, twenty five are with ICCs and other twenty five with FCCs. It is worthy to mention that these pseudo-words are divided into two groups; thirty impossible words while the rest are potentially possible (from both ICCs and FCCs) English words if someone decides to use them. This test aims at identifying the understanding of English phonotactic system by Sudanese EFL undergraduates. For this test, the participants are asked to decide whether the pseudo-words are potentially possible (P) or impossible (I) English words.

### 3.4.3 Observation Checklist

The third instrument is an observation checklist which is designed to provide a careful description of the teaching and learning process and to gather live data from naturally occurring situation. This observation checklist is comprised of sixteen items which are purposefully designed by taking into consideration the different variables of the study and its theoretical framework. This tool explores the effectiveness of the teaching methods, materials and activities used in teaching the sound system of English language. These sixteen items are scaled with applied, partially applied and not applied.

### 3.4.4 Interview

The last tool is an in-depth semi-structured interview with five open-ended questions. This in-depth semi-structured interview is designed to elicit a vivid picture of the participant's perspective and experience on the research topic.

The interview aims to explore the following:

➢ The awareness of Sudanese EFL university instructors of the differences between the phonotactic system of English and Arabic.

➢ The extent to which Sudanese EFL university instructors acquaint their students the phonotactics differences between their MT and the TL? And their awareness of the effectiveness of these difference on their students' mastery of the L2 pronunciation.

➢ The frequency of chances given by Sudanese EFL university instructors to their students to practise aspects of English sound system especially CCs.

➢ The use of authentic audiovisual materials in teaching the sound system of English language especially CCs.

➢ Sudanese EFL university instructors' opinion about their students' pronunciation problems of ICCs and FCCs and the causes of these problems.

➢ The method Sudanese EFL university instructors employ to remedy their students' problems in pronouncing words involving ICCs and FCCs.

➢ The importance of students' age, personality, phonetic ability, motivation and attitude in attaining a native-like pronunciation.

➢ The reason of Sudanese EFL undergraduates' failure to correctly pronounce English words containing ICCs and FCCs.

## 3.5 Validity and Reliability

The researcher adopts face and content validity in which he meets the professors in person to validate the content of the instruments. As for the reliability, the researcher uses a pre and post-test type of reliability.

### 3.5.1 Validity

The researcher shows the instruments (two tests, an interview and an observation checklist) to four professors at different English language departments; Al-Neelain University (Faculty of Arts), Sudan University of Science and Technology (College of Languages) and Nahda College (English Language Programme) in order to validate the instruments (see appendix E for more information about the validation committees). The professors validate these tools after giving their valuable comments and modifications then the researcher applies them in the last version of the instruments before administering them to the students.

### 3.5.2 Reliability

The researcher carries out a pilot study on ten participants (second level for test one and fourth level for test two) from Al-Neelain University who are not included in the main sample of this study in order to test the reliability of the first and second tests. The researcher asks the participants to read the word-list reading tasks of the test twice in two different days. The participants score the same results in both times and they assure the research problem of inserting a vowel and deleting a consonant sound. Therefore, the test is reliable as long as the same results are obtained twice. For the statistical analysis of the pilot study see table 3.2 below in which the paired sample statistics of the correlation between the first and second time is 0.95. As for the second test, the participants are asked to do the written test

two in two different days in which the results of both times show a statistically significant paired sample statistics of correlation between the first and second time (see table 3.3 below).

**Table 3.2** Paired sample statistics for the reliability of test one

|  | Mean | Correlation | Sig. |
|---|---|---|---|
| **First time** | 8.00 | 0.95 | 5.75 |
| **Second time** | 7.90 | | |

**Table 3.3** Paired sample statistics for the reliability of test two

|  | Mean | Correlation | Sig. |
|---|---|---|---|
| **First time** | 32.10 | 0.98 | 0.38 |
| **Second time** | 31.60 | | |

## 3.6 Procedures

### 3.6.1 Procedure of Data Collection

The procedure of collecting the data takes place in an empty and quite lecture halls in the campus of Al-Neelain University, SUST, Nahda College and Almughtaribeen University respectively, though some are collected in instructors' offices. Before engaging in collecting the data, all participants (for both tests) are informed about the purpose of the study, the procedure to be followed and the aim of each test which is mainly to measure their pronunciation skill and phonological awareness with no revelation of the precise focus or the true nature of the investigation. Some participants, however, ask for more details the researcher assures them to have comprehensive details about the tests after the recording session and answering the second test.

As for the word-list reading test, each participant, after consenting to participate in the study, being informed that this session is recorded and kept confidentially and is only disclosed for the purpose of this study and is going to be deleted immediately after its defence, is given the test on a separate sheet of paper and spends two to three minutes to have a look at the test and to become familiar with its content before they are asked to record their performance. To reduce the possibility of changes in speech and anxiety, which might result from being aware of the recording process, a friendly and informal chat with the participants regarding their experience and attitude towards English language is carried out prior to the recording. They are also recorded individually and advised to pause between each word for readability. 'Audacity' version 2.2.1 software programme is employed to record the participants' performance in WAV format along with HP microphone. The recording for each participant lasted approximately four minutes for both sections of the word-list reading test.

With respect to the second test, the participants at Al-Neelain University, SUST, Nahda College and Almughtaribeen University respectively are asked to write the letter (P) for the potentially possible English words and the letter (I) for the impossible ones in the provided space in front of each word. The researcher administers the test to the participants in their lecture halls after taking permission from their instructors at the end of their lectures at the previously mentioned universities. Following this, and to minimise any potential test effects, the researcher explains the rubric especially the words 'potentially' and 'pseudo-words' in the participants' native language. Despite the large number of words in the test, it takes about twelve to fifteen minutes to be completed and it is submitted at the same time.

With regard to the observation which is the third tool to be carried out, the researcher attends an hour-and-a-half lecture on CCs and phonotactics at the same previously mentioned universities. While the instructors deliver their lectures in the presence of almost all students, the researcher, without any involvement, observes the teaching process with the previously prepared checklist items with three scales (applied, partially applied and not applied). Before that, the researcher kindly asks the instructor to deliver their lecture as they always do and to follow the same teaching approach. The students, however, do not have a prior knowledge of this observation and this is mainly to have as much as possible a natural environment and not to be affected with the observation session.

As for the interview and after consenting to participate in the study, all participants are informed that the interview is recorded and kept confidentially and is only disclosed for the purpose of the study at hand and is going to be deleted immediately after its defence. The interview session is conducted in the offices of the four instructors; each at her/his university. 'Audacity' version 2.2.1 software programme is also employed to record the interview in WAV format along with HP microphone. The recording for each participant lasted approximately fifteen minutes for all questions including the experience questions too.

### 3.6.2 Procedure of Data Analysis

For both (the word-list reading test and interview) recorded data, 'Audacity' version 2.2.1 software programme is employed to reduce the background sounds/noise which is technically termed as white noise. This noise reduction process is basically used to filter the unwanted noise and to avoid any confusion while analysing the data. It also utilises Aknan RS 518 loudspeaker to obtain high quality and clear sound.

The data of the word-list reading test is fed into 'Praat' version 6.0.55 – a free computer software package for speech analysis in phonetics and phonology designed and continuously developed by Paul Boersma and David Weenink at the University of Amsterdam. An acoustic waveform produced by this software programme is used to display a visual scan and identify whether the collected data has an epenthetic vowel or not. Following this, and in order to analyse and identify the syllable structure of ICCs and FCCs, the researcher manually transcribes the participants' performance phonemically to appear in the visual scan. Each word in the test is analysed individually from each participant. Again following this, the researcher uses a simple statistical process to calculate the participants' correct and incorrect pronunciation and to give the percentage and the mean score for each task and participant. The total number of the correct pronunciation is multiplied by one hundred and divided into the total number of the test words. The mean score, on the other hand, is obtained by dividing the percentage of the correct pronunciation into the total number of the participants. Finally, it should be mentioned that the participants' incorrect pronunciation that emerge from changing a sound with another one does not take into consideration as long as it does not affect the sequence of consonant clusters.

The waveform in figure 3.1a and 3.1b and 3.2a and 3.2b below illustrate the word 'studio' with and without an epenthetic vowel respectively – as they are analysed via Praat. In figure 3.1b, for example, the display shows a speech signal at the onset of the word 'studio' which indicate to the presence of an epenthetic vowel /i/ before the /s/ sound. By contrast, figure 3.2b demonstrates no speech signal at the onset of the same word before the /s/ sound which suggests the absence of the epenthetic vowel and confirms the correct pronunciation of the word 'studio' as /stu:diəʊ/. For illustrative purpose, a circle is employed in figure 3.1b and 3.2b at

the onset of each waveform representation to clarify the presence and absence of the epenthetic vowel and the oral closure in both figure 3.1a and 3.2a is indicated with X. It is worthy to mention that the word 'studio' is not included in this test.
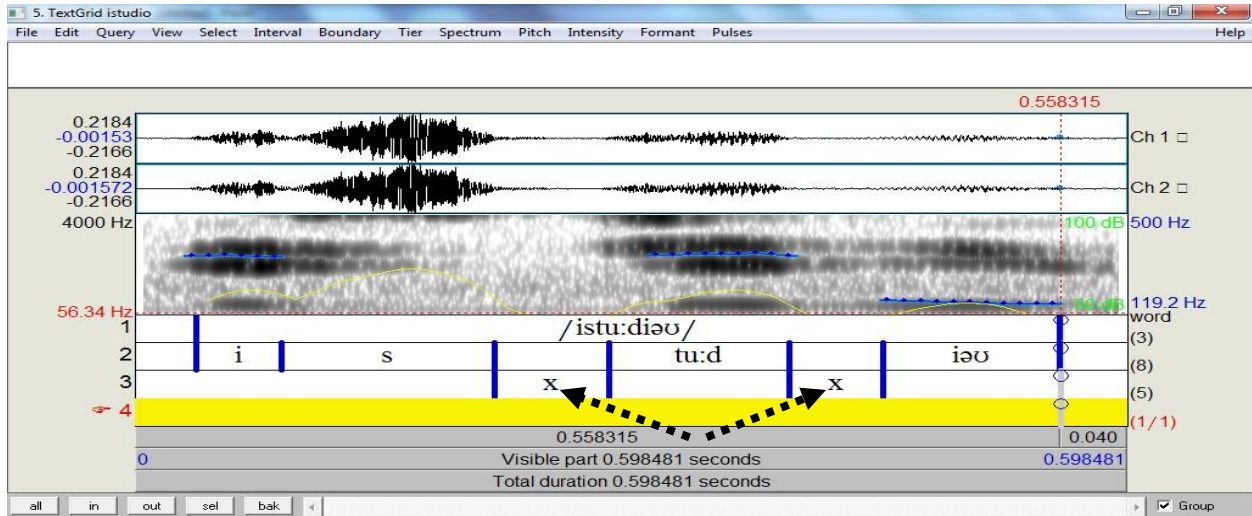


**Figure 3.1a** The segmentation of the word 'studio' with an epenthetic vowel
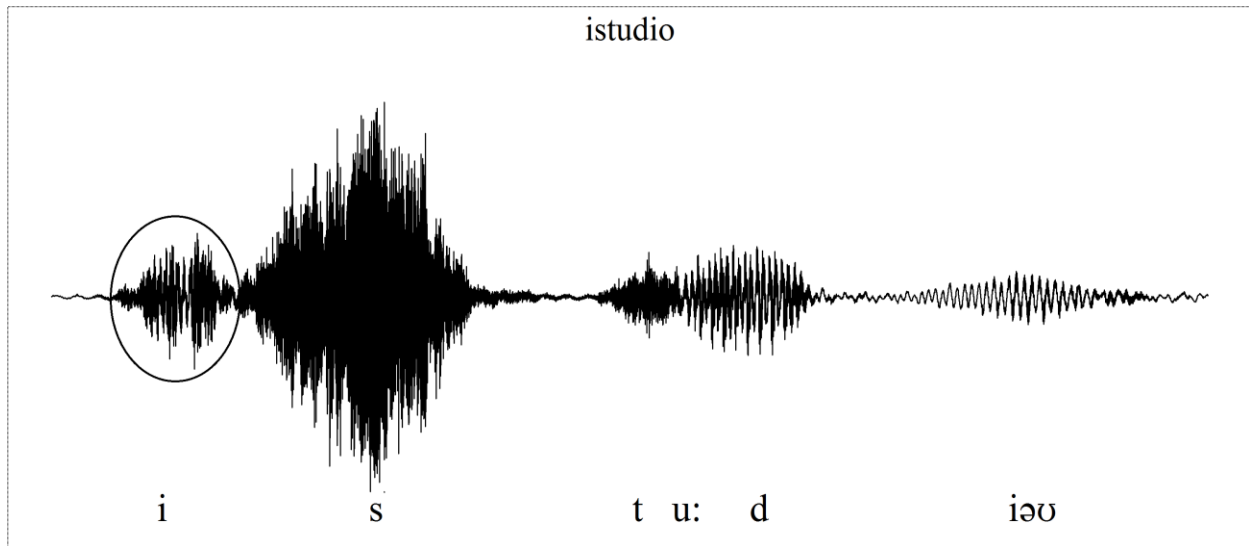


**Figure 3.1b** Waveform for the word 'studio' with an epenthetic vowel /i/
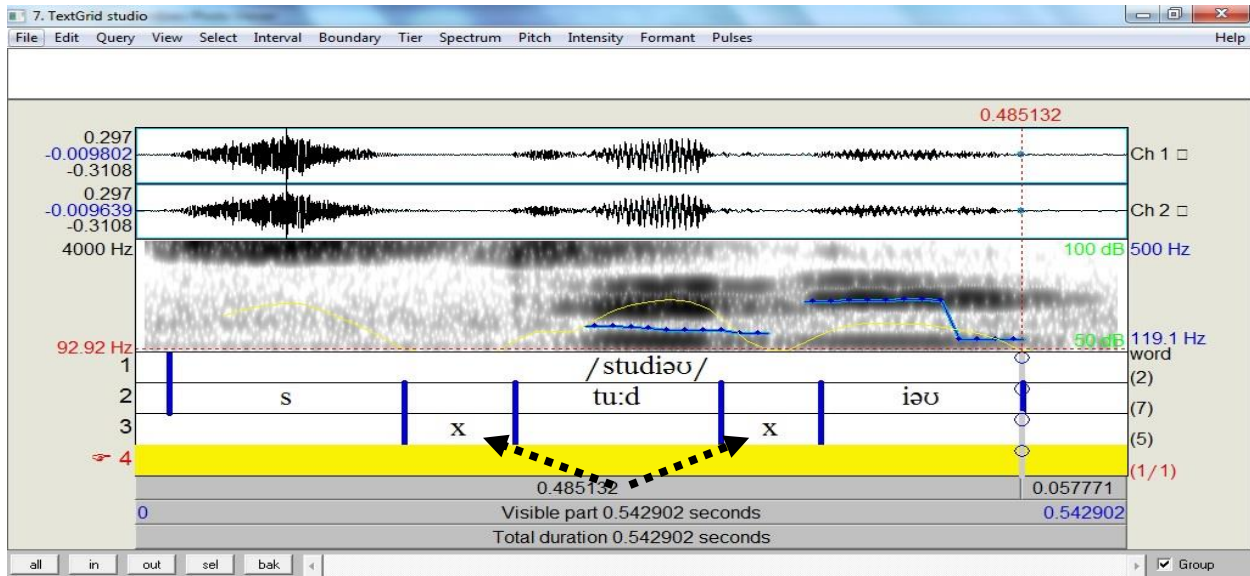
**Figure 3.2a** The segmentation of the word 'studio' without an epenthetic vowel
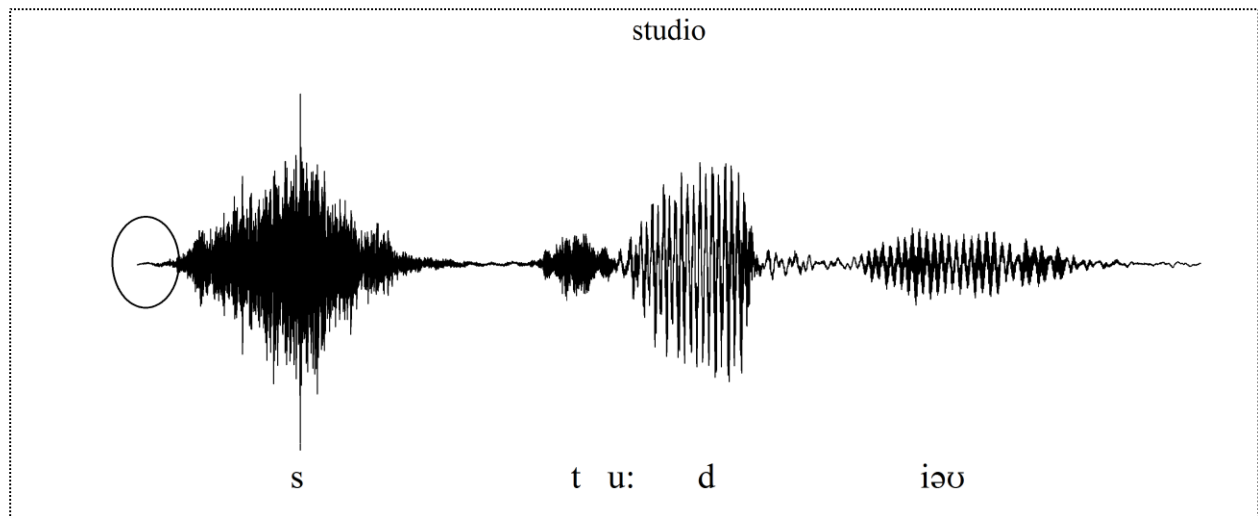


**Figure 3.2b** Waveform for the word 'studio' without an epenthetic vowel /i/

Regarding the second test, the researcher employs the Statistical Package for Social Sciences (SPSS) to analyse the data. Following this, an explanatory report is also presented for each table and chart in order to offer a detailed account to the numbers and statistical percentage in each table and smart chart.

As for the observation, it is firstly presented with its ticked three scaled levels. Following this, an explanatory report is provided for all items in the checklist in order to offer a detailed description and commentary.

The last instrument, which is the interview, is analysed and reported in a form of a text and offers a comprehensive description of the participants' experience. Following this, a commentary report is presented based on the study's theoretical framework for each participant.

## 3.7 Summary

This chapter provides a detailed description of the method adopted in this study. Additionally, it describes the instruments employed for collecting the data. The chapter also presents the population and sample of the study. Furthermore, it shows the validity and reliability of the instruments implemented in this thesis. Finally, it provides the procedure pursued in collecting and analysing the data. The next chapter presents the findings emanating from the analysis of the data.

# CHAPTER FOUR

## Data Analysis, Results and Discussion

### 4.0 Introduction

This chapter shows the results of the data gathered through two tests, interview and observation checklist. It also presents a comprehensive discussion of the results. It is worthy to mention that results and discussion are shown according to the order of the research questions. The quantitative data is illustrated using tables and figures which are two indispensable tools for statistic presentation along with a range of statistic scores such as mean, standard deviation (henceforth, SD), minimum and maximum and mean difference (henceforth, MD).

### 4.1 Data Analysis and Results

As mentioned earlier (see section 1.3) the aim of this study is to identify the magnitude of Sudanese EFL undergraduates understanding and mastering of English phonotactics of words involving ICCs and FCCs, explore the causes of the incorrect pronunciation of English words involving ICCs and FCCs as performed by Sudanese EFL undergraduates, explore the effectiveness of the teaching methods, materials and activities used in teaching the sound system of English language to Sudanese EFL undergraduates, to achieve these goals the researcher poses five questions, whose answers are shown below and compared to the research hypotheses mentioned in the introductory chapter (see section 1.5). To that end, this section is meant to interpret the results obtain by the word list reading test, interview and observation checklist. It is worthy to mention that as long as this study is concerned with English CCs, incorrect pronunciation which emerges by substituting such as /b/ instead of /p/ and /s/ instead of /θ/ is ignored. This

ignorance is due to the fact that many Sudanese EFL students face difficulties in pronouncing these two consonant sounds as investigated by Abayazeed and Abdalla (2017), Ahmed and Abuelhassan (2017) and Hassan (2014). Thus, attention is paid to incorrect pronunciation which emerges due to unrequired pause between CC in one syllable, vowel insertion and consonant deletion. Not only that, but also attention is paid to causes that give rise to incorrect pronunciation apart from the ones mentioned earlier.

## 4.2 Analysis and Results of Research Question One and Three

7. *To what extent do Sudanese EFL undergraduates understand and master English phonotactics of words involving ICCs?*

3. *What are the causes of the incorrect pronunciation of English words involving ICCs and FCCs as performed by Sudanese EFL undergraduates?*

English ICCs are divided into two types; two and three ICCs (see section 2.7.4). As it is well known now two ICCs are further divided into two types, for the sake of this section these two types are designated as two ICCs without /s/ and two ICCs with /s/. To that end, the results and discussion are presented and discussed according to the previously mentioned types and order. It is also worthy to mention that the understanding aspect is answered by the pseudo-word test and the mastering one is answered by the word-list reading test.

Before leaving this sequence, it is also important to point out that the answers for question one are gathered from three instruments; the two tests and interview while question three is only gathered through the word-list reading test.

For general overview table 4.1 bellow illustrates the mean, mode, SD, minimum, maximum, MD and sig. score of the correct and incorrect answer of the pseudo-

word test and correct and incorrect pronunciation of the word-list reading test for all ICCs.

**Table 4.1** general statistics of ICCs in both pseudo-word and word-list reading tests

| Statistics | Pseudo-word Test | | | | | | Word-list Reading Test | | | | | |
| | Two ICCs without /s/ | | Two ICCs with /s/ | | Three ICCs | | Two ICCs without /s/ | | Two ICCs with /s/ | | Three ICCs | |
| | CA | IA | CA | IA | CA | IA | CP | IP | CP | IP | CP | IP |
| Mean | 8.25 | 4.40 | 3.22 | 1.64 | 5.23 | 1.60 | 2.87 | 1.20 | 1.43 | 2.57 | 1.45 | 2.53 |
| Mode | 9 | 3 | 3 | 2 | 6 | 1 | 3 | 1 | 0 | 4 | 0 | 2 |
| SD | 2.03 | 1.88 | 1.115 | 1.20 | 1.601 | 1.470 | .929 | .988 | 1.307 | 1.307 | 1.185 | 1.171 |
| Minimum | 3 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Maximum | 12 | 9 | 5 | 5 | 7 | 7 | 4 | 3 | 4 | 4 | 4 | 4 |
| MD | -4.750 | | -1.780 | | -1.770 | | -1.133 | | -2.567 | | -2.550 | |
| Sig. | 0.000 | | 0.000 | | 0.000 | | 0.000 | | 0.000 | | 0.000 | |

### 4.2.1 Analysis and Results of Two ICCs without /s/

The results of the pseudo-words test of two ICCs without /s/ as illustrated in table 4.2 below demonstrates that the mean score of the incorrect answer is lower than the correct one which is basically acceptable but as compared to the MD (-4.750), there is a great difference between the correct and incorrect answer, which is also higher than sig level (0.000) that is hypothesised by the current study. This hypothesis assumes that all participants should answer the 13 pseudo-words correctly as potentially possible or impossible English words and the MD is supposed to be (0.000) not (-4.750).

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**Table 4.2** Mean score of the correct and incorrect answers of two ICCs without /s/.

| Statistics | Correct answer | Incorrect answer |
|:---:|:---:|:---:|
| **Mean** | 8.25 | 4.40 |
| **Mode** | 9 | 3 |
| **SD** | 2.03 | 1.88 |
| **Minimum** | 3 | 1 |
| **Maximum** | 12 | 9 |
| **MD** | -4.750 | |
| **Sig.** | 0.000 | |

As illustrated in table 4.3 below the least score of the correct and incorrect answer of the pseud-word test of two ICCs without /s/ is 3 and 1 which is scored by 2 and 7 participants respectively and the highest score is 12 and 9 which is also scored by 5 and 1 participants respectively. 23 participants miss 10 words; 14 participants miss 1 word, 6 participants miss 2 words, 1 participant misses 3 words and 2 participants miss 4 words.

**Table 4.3** Frequency of correct, incorrect answer and missing value of two ICCs without /s/

| Correct answer | | Incorrect answer | | Missing value | |
|:---:|:---:|:---:|:---:|:---:|:---:|
| Score | Frequency | Score | Frequency | Score | Frequency |
| 3 | 2 | 1 | 7 | 0 | 77 |
| 4 | 1 | 2 | 6 | 1 | 14 |
| 5 | 8 | 3 | 24 | 2 | 6 |
| 6 | 9 | 4 | 15 | 3 | 1 |
| 7 | 14 | 5 | 20 | 4 | 2 |

| 8 | 16 | 6 | 14 | | |
|---|---|---|---|---|---|
| 9 | 20 | 7 | 8 | | |
| 10 | 20 | 8 | 5 | | |
| 11 | 5 | 9 | 1 | | |
| 12 | 5 | | | | |

Figure 4.1a and 4.1b below show a significant difference between the correct and incorrect answer of pseudo-words involving two ICCs without /s/ in percentage. In 8 pseudo-words the participants score more that 65% out of 13, in 3 between 50% and 64% and in 2 less than 50%. From these figures it is noticeable that the highest percentage of CA is 86% in the pseud-word *'proklem' and the least is 30% in *'shyoon'.



| Two ICCs without /s/ A | hreem | nsaph | lwam | jlow | proklem | shyoom |
|---|---|---|---|---|---|---|
| % of CA | 64 | 76 | 61 | 76 | 86 | 30 |
| % of IA | 36 | 22 | 32 | 21 | 14 | 69 |
| Missing | 0 | 2 | 7 | 3 | 0 | 1 |
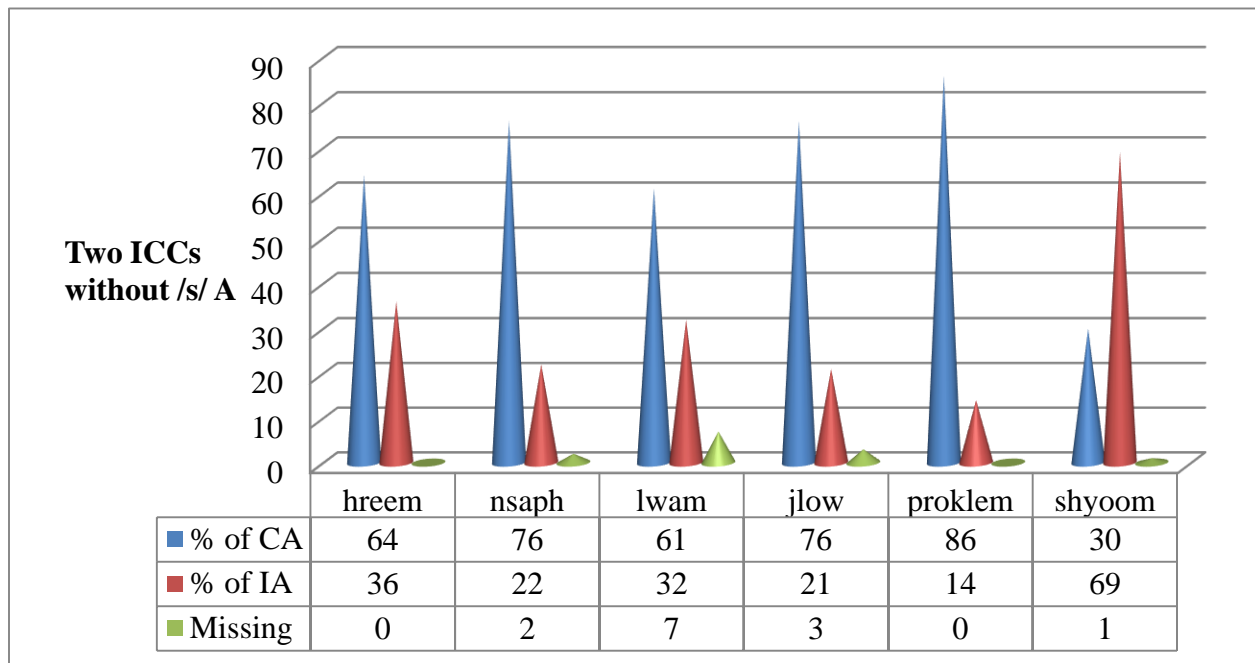
**Figure 4.1a** percentage of correct, incorrect and missing answer of two ICCs without /s/

*CA= correct answer *IA= incorrect answer

| Two ICCs without /s/ B | dless | rlism | fwin | vrog | bnack | blick | rbel |
|---|---|---|---|---|---|---|---|
| ■ % of CA | 69 | 44 | 69 | 60 | 50 | 77 | 66 |
| ■ % of IA | 28 | 55 | 29 | 36 | 46 | 18 | 29 |
| ■ Missing | 3 | 1 | 2 | 4 | 4 | 5 | 5 |
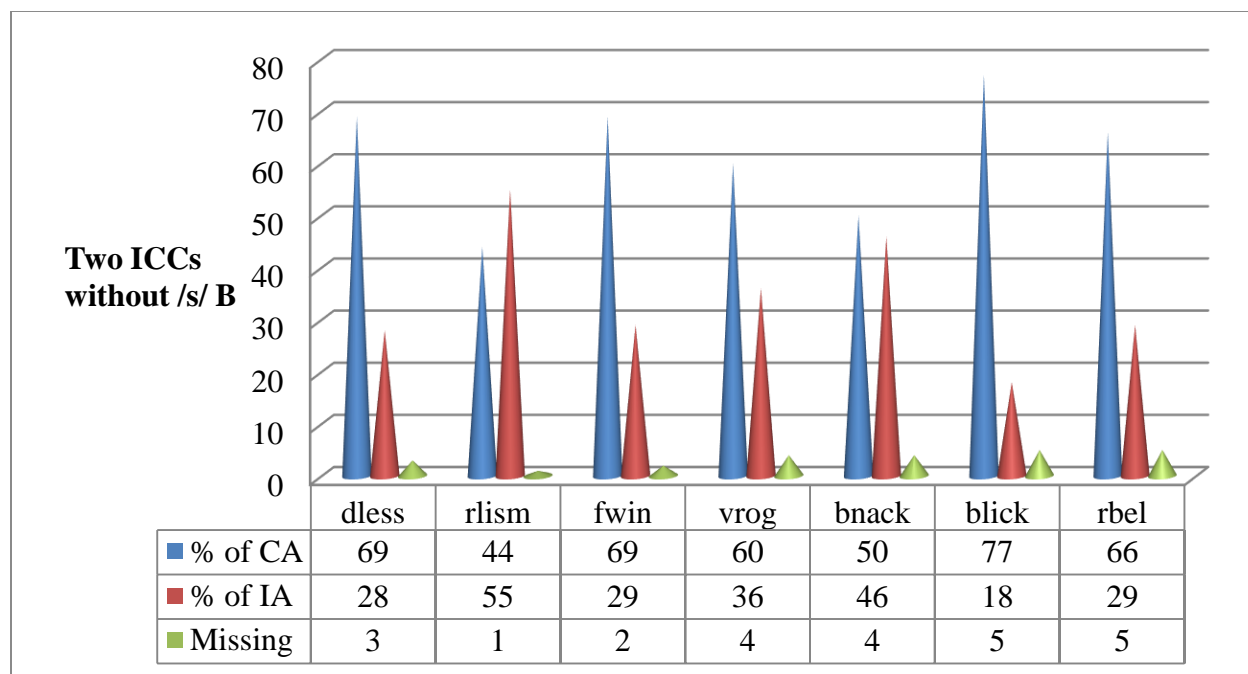
**Figure 4.1b** percentage of correct, incorrect and missing answer of two ICCs without /s/

*CA= correct answer *IA= incorrect answer

According to table 4.4 below which shows the results of the word-list reading test of two ICCs without /s/, the mean score of the correct answer is significantly higher than the incorrect one which is apparent from the MD (-1.133). This MD is also higher than the sig level (0.000) hypothesised by the researcher who assumes that all participants should pronounce the 4 words correctly.

**Table 4.4** Mean score of correct and incorrect pronunciation of two ICCs without /s/

| Statistics | Correct pronunciation | Incorrect pronunciation |
|---|---|---|
| **Mean** | 2.87 | 1.20 |
| **Mode** | 3 | 1 |

| | | |
|---|---|---|
| **SD** | .929 | .988 |
| **Minimum** | 1 | 0 |
| **Maximum** | 4 | 3 |
| **MD** | -1.133 | |
| **Sig.** | 0.000 | |

As illustrated in table 4.5 below the least score of the correct and incorrect pronunciation of the word-list reading test of two ICCs without /s/ is 1 and 0 which is scored by 6 and 16 participants respectively and the highest score is 4 and 3 which is also scored by 16 and 6 participants respectively.

**Table 4.5** Frequency of correct and incorrect pronunciation of two ICCs without /s/

| Correct pronunciation | | Incorrect pronunciation | |
|---|---|---|---|
| **Score** | **Frequency** | **Score** | **Frequency** |
| 1 | 6 | 0 | 16 |
| 2 | 12 | 1 | 26 |
| 3 | 26 | 2 | 12 |
| 4 | 16 | 3 | 6 |
| **Total** | **60** | **Total** | **60** |

Figure 4.2 below shows a significant difference between the correct and incorrect pronunciation of English word involving two ICCs without /s/ in percentage. The results indicate that more than 13% of the participants pronounce all words correctly. In the first two words, students do not face much problem in pronouncing the words 'fly' and 'blue' in which 87% and 83% of the total 60 participants pronounce these words correctly, while in the other two words 'pretty'

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and 'shriek', more than 37% of the participants fail to correctly pronounce them. From this figure, it is noticeable that the highest percentage of CP is 87% in the word 'fly' and the least is 53% in 'pretty'.



| Two ICCs without /s/ | fly | blue | pretty | shriek |
|---|---|---|---|---|
| ■ Total No. of CP | 52 | 50 | 32 | 38 |
| ■ % of CP | 87% | 83% | 53% | 63% |
| ■ Total No. of IP | 8 | 10 | 28 | 22 |
| ■ % of IP | 13% | 17% | 47% | 37% |
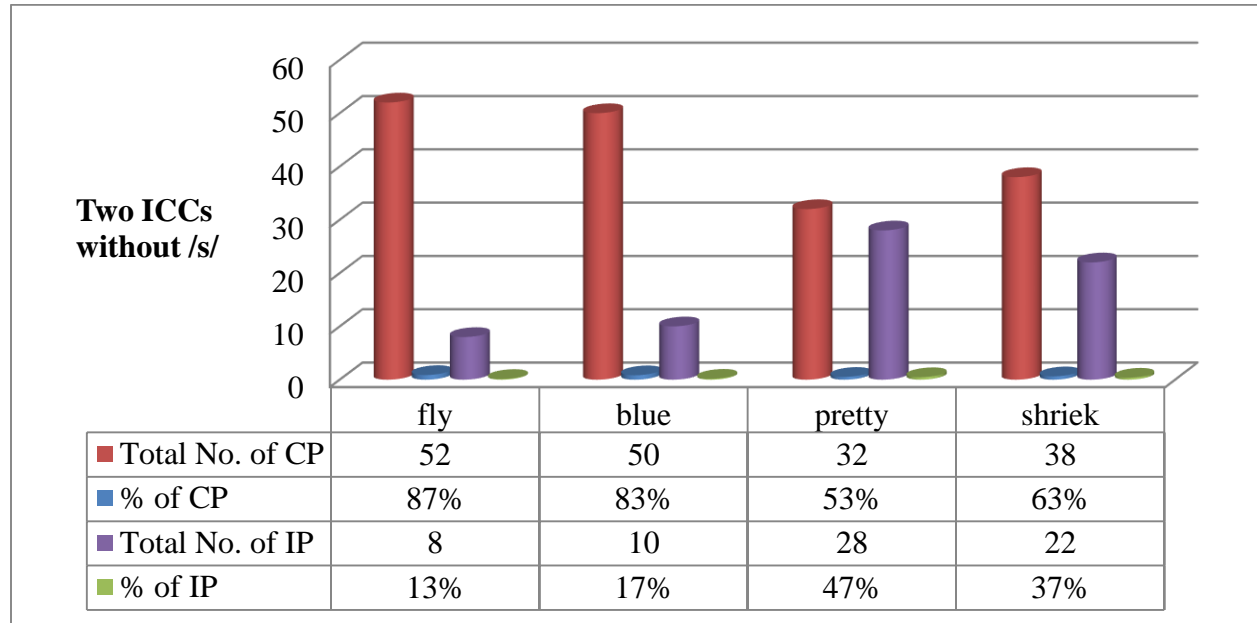
**Figure 4.2** Total number and percentage of correct and incorrect pronunciation of two ICCs without /s/

*CP= correct pronunciation *IP= incorrect pronunciation

As shown in figure 4.3 below the major reason of the incorrect pronunciation of the word 'fly' is caused by inserting a mid centre short vowel /ə/, inserting a high front short vowel /ɪ/, unrequired pause and incomprehensibility. The percentages are 43%, 29%, 14% and 14% respectively for each cause. It also shows that the incorrect pronunciation of the word 'blue' is caused by inserting a mid centre short vowel /ə/, and inserting a vowel /ʊ/. The percentage of each cause is 21% and 2% respectively. The incorrect pronunciation of the word 'pretty' is caused by unrequired pause O*, inserting a mid centre short vowel /ə/, unrequired pause W*, incomprehensibility and inserting a high front short vowel /ɪ/. The percentages are

40%, 14%, 9%, 9% and 5% respectively. The last word of this group is 'shriek', and it is incorrect pronunciation is caused by conversion of C and V position, inserting a mid centre short vowel /ə/, unrequired pause O, inserting a high front short vowel /ɪ/, deletion of SICC* and incomprehensibility. The percentage of each cause is 50% 18%, 9%, 5%, 5%, and 5% respectively. From this figure, it is noticeable that the insertion of the mid centre short vowel /ə/ is repeated in each word and unrequired pause O in three words and the highest percentage is scored with conversion of C and V position (59%) in the word 'shriek' and insertion of the mid centre short vowel /ə/ (43%) in the word 'fly'.

*Hence, unrequired pause O*, unrequired pause W* and SICC stand for incorrect pronunciation caused by unrequired pause only, incorrect pronunciation caused by unrequired pause in addition to other causes and second ICC respectively.

Hence, it is worthy to mention that the incorrect pronunciation of one word may be due to more than one cause. See appendix F2 for more clarification of the Praat analysis, transcription and results of each word for each participant.
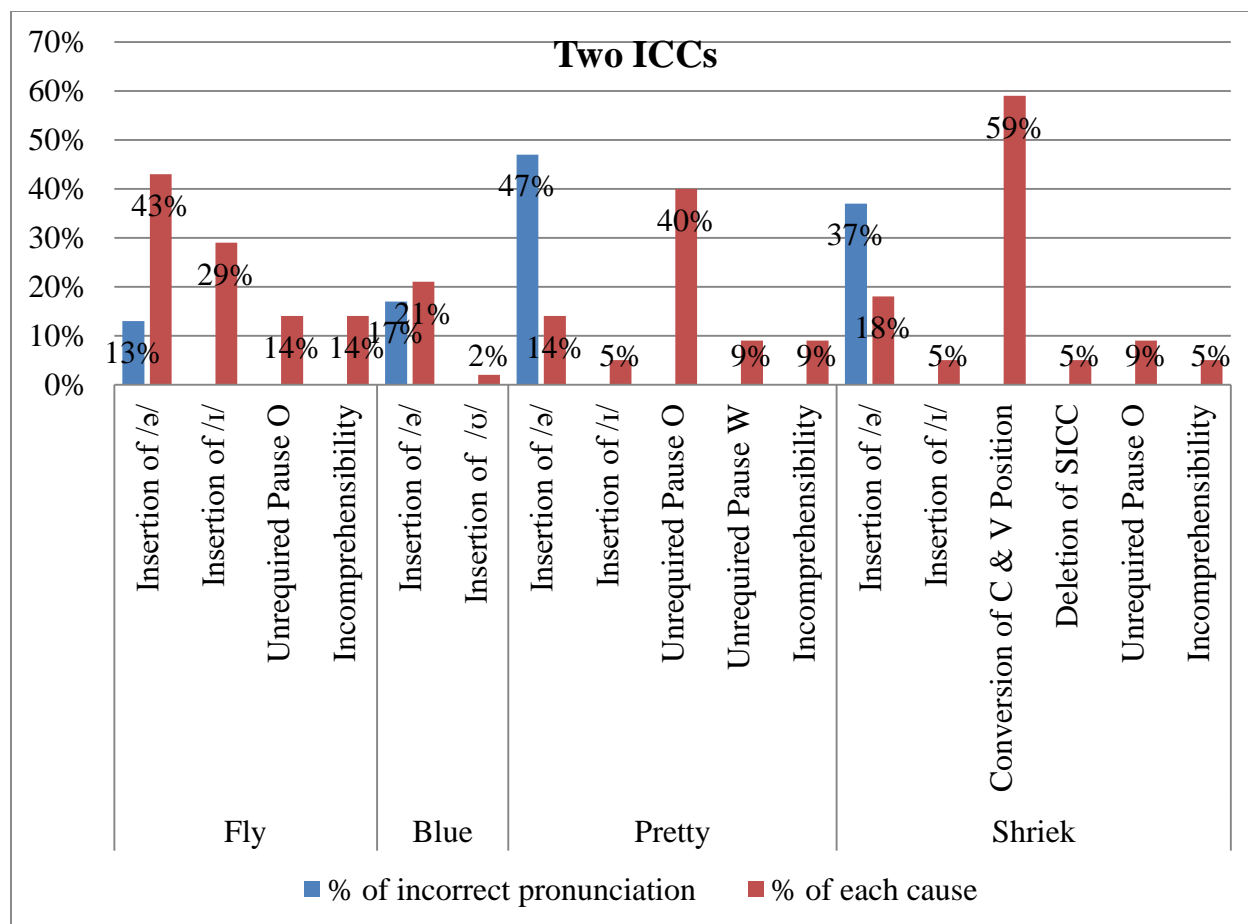
**Figure 4.3** Percentage of each cause of the incorrect pronunciation of two ICCs without /s/

## 4.2.2 Analysis and Results of Two ICCs with /s/

The results of the pseudo-word test of two ICCs with /s/ as illustrated in table 4.6 below demonstrates that the mean score of the incorrect answer is lower than the correct one which is basically acceptable but as compared to the MD (-1.780), there is a great difference between the correct and incorrect answer, which is also higher than sig level (0.000) that is hypothesised by the current study. This hypothesis assumes that all participants should answer the 5 pseudo-words correctly as potentially possible or impossible English words and the MD is supposed to be (0.000) not (-1.780).

**Table 4.6** Mean score of the correct and incorrect answers of two ICCs with /s/

| Statistics | Correct answer | Incorrect answer |
|---|---|---|
| **Mean** | 3.22 | 1.64 |
| **Mode** | 3 | 2 |
| **Std. Deviation** | 1.115 | 1.20 |
| **Minimum** | 0 | 0 |
| **Maximum** | 5 | 5 |
| **MD** | -1.780 | |
| **Sig.** | 0.000 | |

As illustrated in table 4.7 below the least score of the correct and incorrect answer of the pseud-word test of two ICCs with /s/ is 0 for both which is scored by 3 and 13 participants respectively and the highest score is 5 for both which is also scored by 12 and 1 participants respectively. 10 participants miss 6 words; 7 participants miss 1 word, 1 participant misses 2 words and 2 participants miss 3 words.

**Table 4.7** Frequency of correct, incorrect answer and missing value of two ICCs with /s/

| Correct answer | | Incorrect answer | | Missing value | |
|---|---|---|---|---|---|
| **Score** | **Frequency** | **Score** | **Frequency** | **Score** | **Frequency** |
| 0 | 3 | 0 | 13 | 0 | 90 |
| 1 | 1 | 1 | 33 | 1 | 7 |
| 2 | 20 | 2 | 34 | 2 | 1 |
| 3 | 35 | 3 | 18 | 3 | 2 |
| 4 | 29 | 4 | 1 | | |
| 5 | 12 | 5 | 1 | | |

Figure 4.4 below shows a statistically significant difference between the correct and incorrect answer of pseudo-words involving two ICCs with /s/. In 2 pseudo-words the participants score 75% out of 5 and in 3 words they score between 54%

and 59%. From this figure, it is noticeable that the highest percentage of CA is 75% in the pseud-words *'sbort' and *'svour' and the least is 54% in *'sreak'.



| Two ICCs with /s/ | smood | sreak | sbort | sding | svour |
|---|---|---|---|---|---|
| ■ % of CA | 59 | 54 | 75 | 57 | 75 |
| ■ % of IA | 41 | 41 | 23 | 38 | 22 |
| ■ Missed | 0 | 5 | 2 | 5 | 3 |
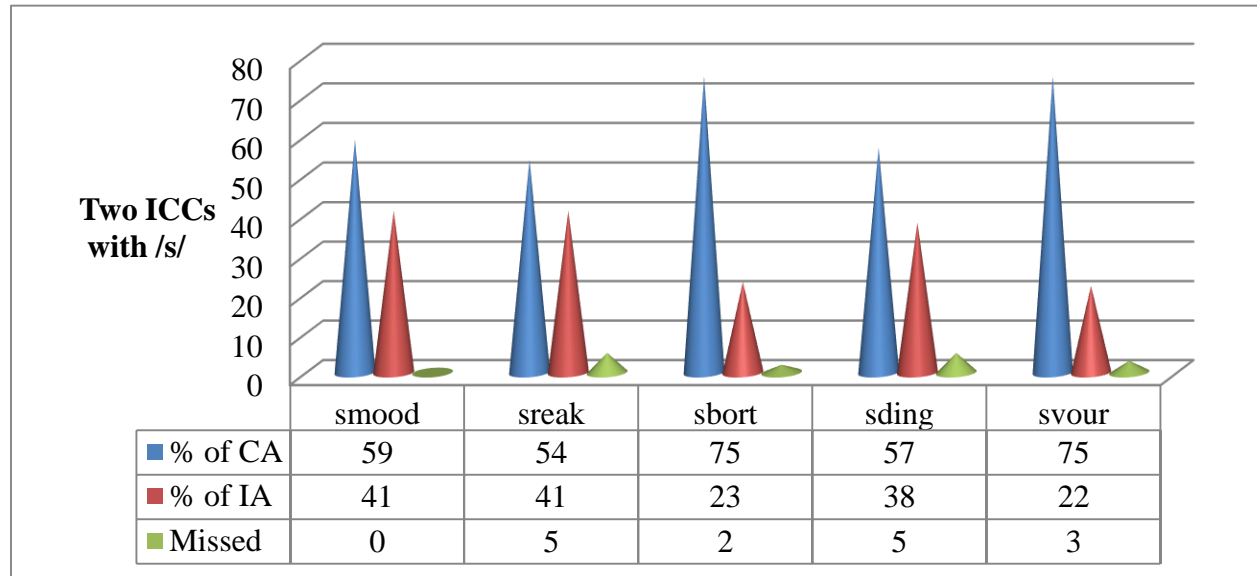
**Figure 4.4** Percentage of correct, incorrect and missed answer of two ICCs with /s/

*CA= correct answer *IA= incorrect answer

According to table 4.8 below which shows the results of the word-list reading test of two ICCs without /s/, the mean score of the correct answer (1.43) is significantly lower than the incorrect one (2.57) which is apparent from the MD (-2.567). This MD is also higher than the sig level (0.000) hypothesised by the researcher who assumes that all participants should pronounce the 4 words correctly and the MD is supposed to be (0.000) not (-2.567).

**Table 4.8** Mean score of the correct and incorrect answers of two ICCs with /s/

| Statistics | Correct pronunciation | Incorrect pronunciation |
|---|---|---|
| Mean | 1.43 | 2.57 |
| Mode | 0 | 4 |
| SD | 1.307 | 1.307 |
| Minimum | 0 | 0 |
| Maximum | 4 | 4 |
| MD | -2.567 | |
| Sig. | 0.000 | |

As illustrated in table 4.9 below the least score of the correct and incorrect pronunciation of the word-list reading test of two ICCs with /s/ is 0 for both which is scored by 21 and 3 participants respectively and the highest score is 4 for both which is also scored by 3 and 21 participants respectively.

**Table 4.9** Frequency of correct and incorrect pronunciation of two ICCs with /s/

| Correct pronunciation | | Incorrect pronunciation | |
|---|---|---|---|
| Score | Frequency | Score | Frequency |
| 0 | 21 | 0 | 3 |
| 1 | 11 | 1 | 13 |
| 2 | 12 | 2 | 12 |
| 3 | 13 | 3 | 11 |
| 4 | 3 | 4 | 21 |
| **Total** | **60** | **Total** | **60** |

Figure 4.5 below shows a statistically significant difference between the correct and incorrect pronunciation of English word involving two ICCs with /s/. The results indicate that more than 52% of the participants fail to correctly pronounce all words. In the first two words, students face much problem in pronouncing the words 'smile' and 'stay' in which only 30% and 28% of the total 60 participants pronounce these words correctly, while in the third word only 48% of the participants are able to correctly pronounce the word 'spin' and 37% the word 'sphere'. From this figure, it is noticeable that the highest percentage of CP is 48% in the word 'spin' and the least is 28% in 'stay'.



| | | smile | stay | spin | sphere |
|---|---|---|---|---|---|
| ■ | Total No. of CP | 18 | 17 | 29 | 22 |
| ■ | % of CP | 30% | 28% | 48% | 37% |
| ■ | Total No. of IP | 42 | 43 | 31 | 38 |
| ■ | % of IP | 70% | 72% | 52% | 63% |

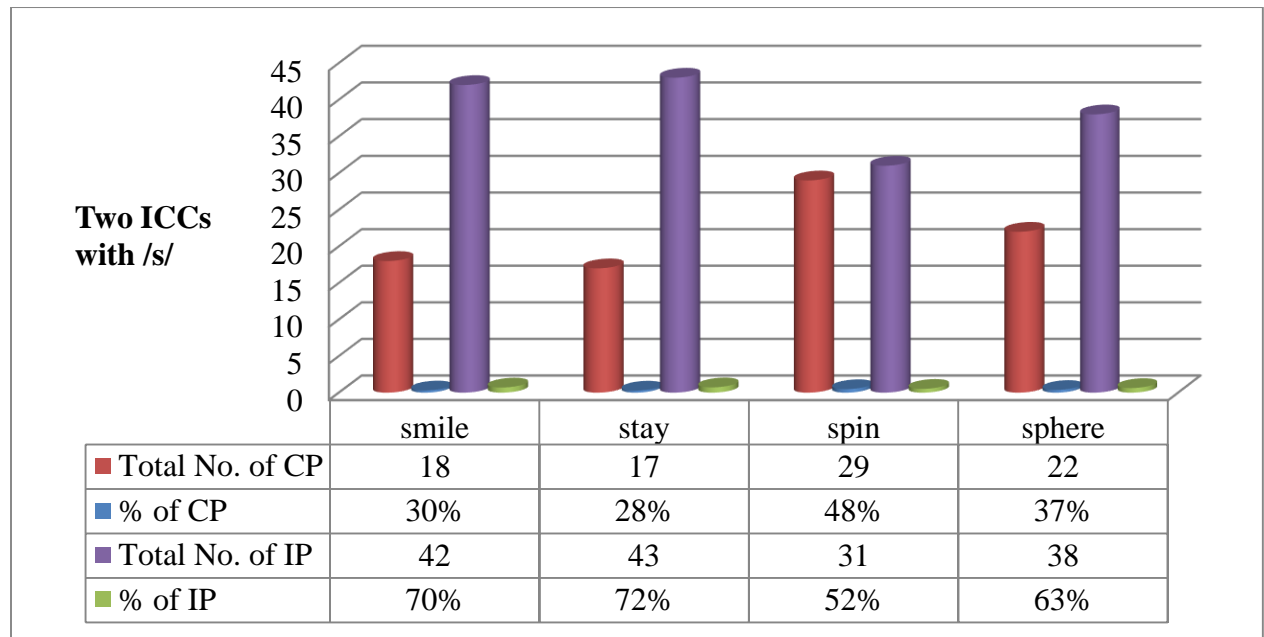**Figure 4.5** Total number and percentage of two ICCs with /s/ correct and incorrect pronunciation

As shown in 4.6 below the major reason of the incorrect pronunciation of the word 'smile' is caused by inserting a mid centre short vowel /ə/, unrequired pause O, inserting a high front short vowel /ɪ/, unrequired pause W and duplication of SICC. The percentages are 46%, 28%, 13%, 11% and 2% respectively for each cause. It

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also shows that the incorrect pronunciation of the word 'stay' is caused by inserting a mid centre short vowel /ə/, inserting a vowel /ɪ/, duplication of SICC and incomprehensibility. The percentage of each cause is 72%, 17%, 9% and 2% respectively. The incorrect pronunciation of the word 'spin' is caused by inserting a mid centre short vowel /ə/, duplication of SICC, inserting a high front short vowel /ɪ/ and unrequired pause W. The percentages are 46%, 26%, 23%, and 5% respectively. The last word of this group is 'sphere', and its incorrect pronunciation is caused by inserting a mid centre short vowel /ə/, inserting a high front short vowel /ɪ/, duplication of SICC, incomprehensibility, unrequired pause O, unrequired pause W, replacement of C and inserting a high front short vowel /ʌ/. The percentage of each cause is 46% 20%, 10%, 7%, 5%, 5%, 5% and 2% respectively. From this figure, it is noticeable that the insertion of the mid centre short vowel /ə/, insertion a high front short vowel /ɪ/ and duplication of SICC are repeated in each word and unrequired pause W in three words and the highest percentage is scored with the insertion of the mid centre short vowel /ə/ (72%) in the word 'stay'.

Again, it is important to point that the incorrect pronunciation of one word may be due to more than one cause. See appendix F2 for more clarification of the Praat analysis, transcription and results of each word for each participant.
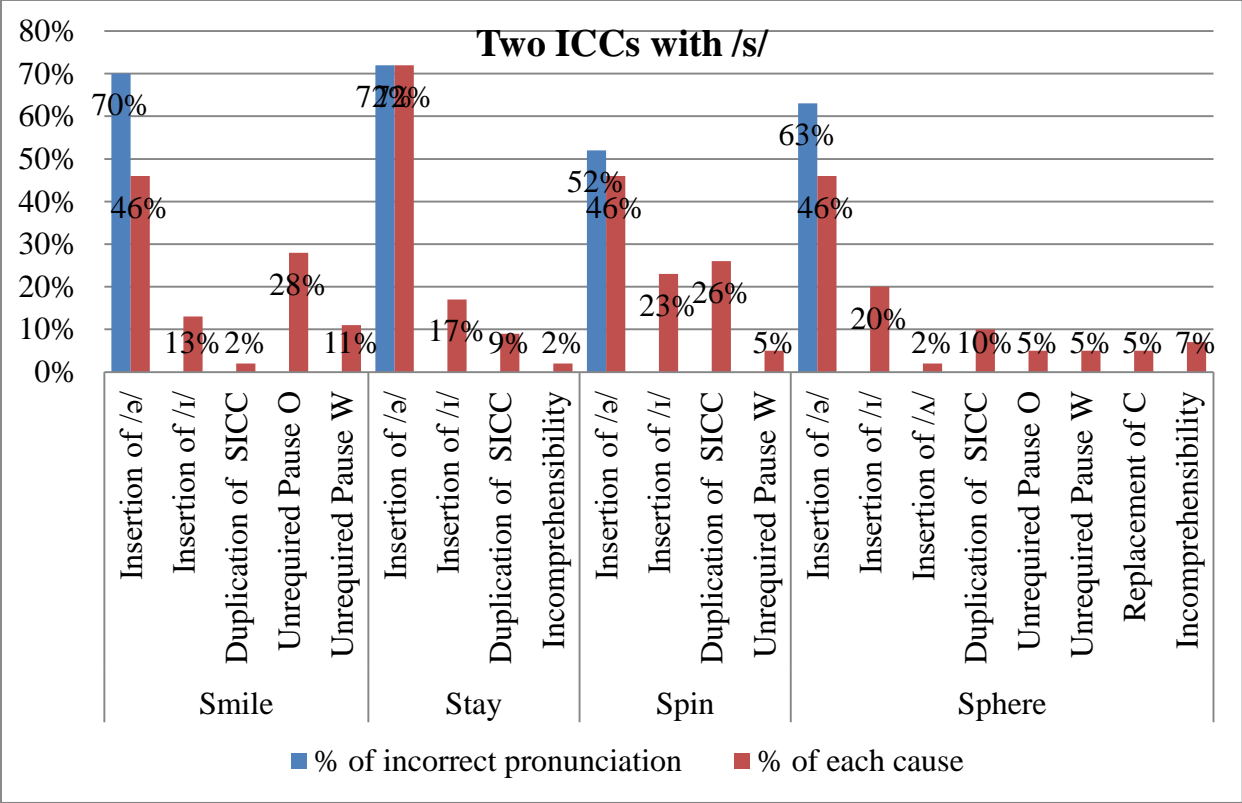
**Figure 4.6** Percentage of each cause of the incorrect pronunciation of two ICCs with /s/

### 4.2.3 Analysis and Results of Three ICCs

The results of the pseudo-word test of three ICCs as illustrated in table 4.10 below demonstrates that the mean score of the incorrect answer is extremely lower than the correct one but as compared to the MD (-1.770), there is a great difference between the correct and incorrect answer, which is also higher than sig level (0.000) that is hypothesised by the current study. This hypothesis assumes that all participants should answer the 5 pseudo-words correctly as potentially possible or impossible English words and the MD is supposed to be (0.000) not (-1.770).

**Table 4.10** Mean score of the correct and incorrect answers of three ICCs

| Statistics | Correct answer | Incorrect answer |
|---|---|---|
| Mean | 5.23 | 1.60 |
| Mode | 6 | 1 |
| SD | 1.601 | 1.470 |
| Minimum | 0 | 0 |
| Maximum | 7 | 7 |
| MD | -1.770 | |
| Sig. | 0.000 | |

As illustrated in table 4.11 below the least score of the correct and incorrect answer of the pseud-word test of three ICCs is 0 for both which is scored by 1 and 26 participants respectively and the highest score is 7 for both which is also scored by 24 and 1 participants respectively. 6 participants miss 8 words; 3 participants miss 1 word, 1 participant misses 2 words and 2 participants miss 5 words.

**Table 4.11** Frequency of correct, incorrect answer and missing value of three ICCs

| Correct answer | | Incorrect answer | | Missing value | |
|---|---|---|---|---|---|
| Score | Frequency | Score | Frequency | Score | Frequency |
| 0 | 1 | 0 | 26 | 0 | 94 |
| 1 | 1 | 1 | 31 | 1 | 3 |
| 2 | 6 | 2 | 16 | 2 | 1 |
| 3 | 6 | 3 | 17 | 5 | 2 |
| 4 | 15 | 4 | 7 | | |
| 5 | 18 | 5 | 1 | | |
| 6 | 29 | 6 | 1 | | |
| 7 | 24 | 7 | 1 | | |

Figure 4.7 below shows a significant difference between the correct and incorrect answer of pseudo-words involving three ICCs. In 2 pseudo-words the participants score 87% and 85% out of 7, in 3 words they score between 73% and 77% and in 2

words they score 59% and 68%. From this figure, it is noticeable that the highest percentage of CA is 87% in the pseud-words *'stram' and the least is 59% in *'rskar'.



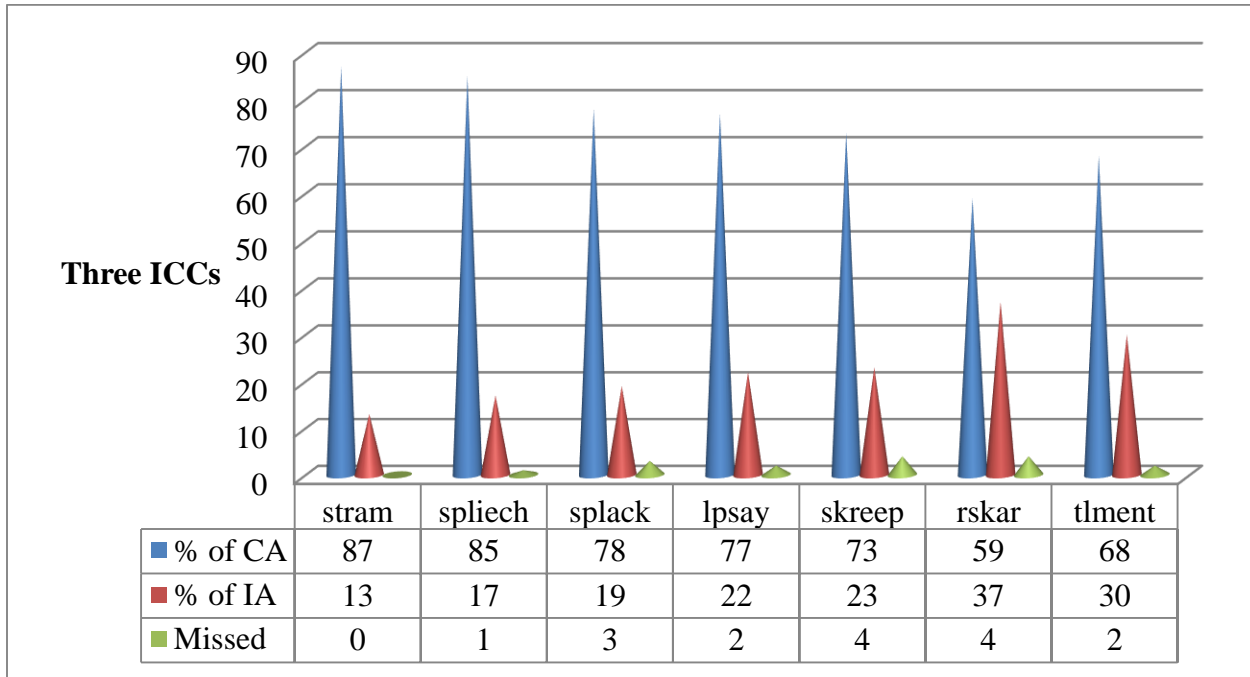| | stram | spliech | splack | lpsay | skreep | rskar | tlment |
|---|---|---|---|---|---|---|---|
| ■ % of CA | 87 | 85 | 78 | 77 | 73 | 59 | 68 |
| ■ % of IA | 13 | 17 | 19 | 22 | 23 | 37 | 30 |
| ■ Missed | 0 | 1 | 3 | 2 | 4 | 4 | 2 |

**Figure 4.7** Percentage of correct, incorrect and missed answer of three ICCs

*CA= correct answer *IA= incorrect answer

According to table 4.12 below which shows the results of the word-list reading test of two ICCs without /s/, the mean score of the correct answer (1.45) is significantly lower than the incorrect one (2.53) which is apparent from the MD (-2.550). This MD is also higher than the sig level (0.000) hypothesised by the researcher who assumes that all participants should pronounce the 4 words correctly and the MD is supposed to be (0.000) not (-2.550).

**Table 4.12** Mean score of the correct and incorrect answers of three ICCs

| Statistics | Correct pronunciation | Incorrect pronunciation |
|---|---|---|
| Mean | 1.45 | 2.53 |
| Mode | 0 | 2 |
| SD | 1.185 | 1.171 |
| Minimum | 0 | 0 |
| Maximum | 4 | 4 |
| MD | -2.550 | |
| Sig. | 0.000 | |

As illustrated in table 4.13 below the least score of the correct and incorrect pronunciation of the word-list reading test of two ICCs with /s/ is 0 for both which is scored by 16 and 2 participants respectively and the highest score is 4 for both which is also scored by 2 and 16 participants respectively.

**Table 4.13** Frequency of correct and incorrect pronunciation of three ICCs

| Correct pronunciation | | Incorrect pronunciation | |
|---|---|---|---|
| Score | Frequency | Score | Frequency |
| 0 | 16 | 0 | 2 |
| 1 | 15 | 1 | 11 |
| 2 | 16 | 2 | 16 |
| 3 | 11 | 3 | 15 |
| 4 | 2 | 4 | 16 |
| Total | 60 | Total | 60 |

Figure 4.8 below shows a statistically significant difference between the correct and incorrect pronunciation of English word involving three ICCs. The results indicate that more than 57% of the participants fail to correctly pronounce all words.

In the third word, students face much problem in pronouncing the word 'stew' in which only 22% of the total 60 participants pronounce this word correctly, while in the second and forth word, only 38% of the participants are able to correctly pronounce the words 'squeak' and 'splay' and 43% the word 'spread'. From this figure, it is noticeable that the highest percentage of CP is 43% in the word 'spread' and the least is 22% in 'stew'.



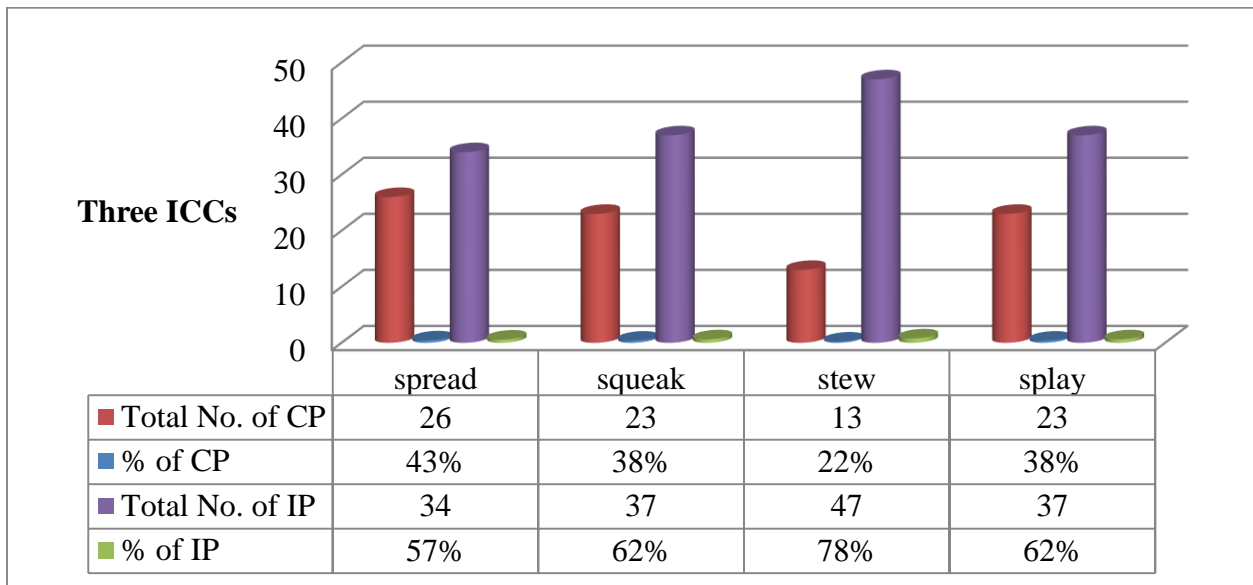| Three ICCs | spread | squeak | stew | splay |
|---|---|---|---|---|
| ■ Total No. of CP | 26 | 23 | 13 | 23 |
| ■ % of CP | 43% | 38% | 22% | 38% |
| ■ Total No. of IP | 34 | 37 | 47 | 37 |
| ■ % of IP | 57% | 62% | 78% | 62% |

**Figure 4.8** Total number and percentage of three ICCs correct and incorrect pronunciation

As shown in figure 4.9 below the major reason of the incorrect pronunciation of the word 'spread' is caused by inserting a mid centre short vowel /ə/, duplication of SICC, inserting a high front short vowel /ɪ/, conversion of C and V position,

incomprehensibility and unrequired pause W. The percentages are 53%, 27%, 7%, 7%, 4% and 2% respectively for each cause. It also shows that the incorrect pronunciation of the word 'squeak' is caused by inserting a mid centre short vowel /ə/, inserting a vowel /ɪ/, duplication of SICC deletion of SICC unrequired pause W and incomprehensibility. The percentage of each cause is 41%, 22%, 16%, 11% 5% and 5% respectively. The incorrect pronunciation of the word 'stew' is caused by inserting a mid centre short vowel /ə/, inserting a high front short vowel /ɪ/, duplication of SICC, incomprehensibility and unrequired pause W. The percentages are 55%, 26%, 11%, 6% and 2% respectively. The last word of this group is 'splay', and its incorrect pronunciation is caused by inserting a mid centre short vowel /ə/, inserting a high front short vowel /ɪ/, duplication of SICC and incomprehensibility. The percentage of each cause is 54 32%, 12%, and 2% respectively. From these results, it is noticeable that the insertion of the mid centre short vowel /ə/, insertion a high front short vowel /ɪ/ and duplication of SICC are repeated in each word and unrequired pause W in three words and the highest percentage is scored with the insertion of the mid centre short vowel /ə/ (55%) in the word 'stew'.

Again, it is worthy to mention that the incorrect pronunciation of one word may be due to more than one cause. See appendix F2 for more clarification of the Praat analysis, transcription and results of each word for each participant.
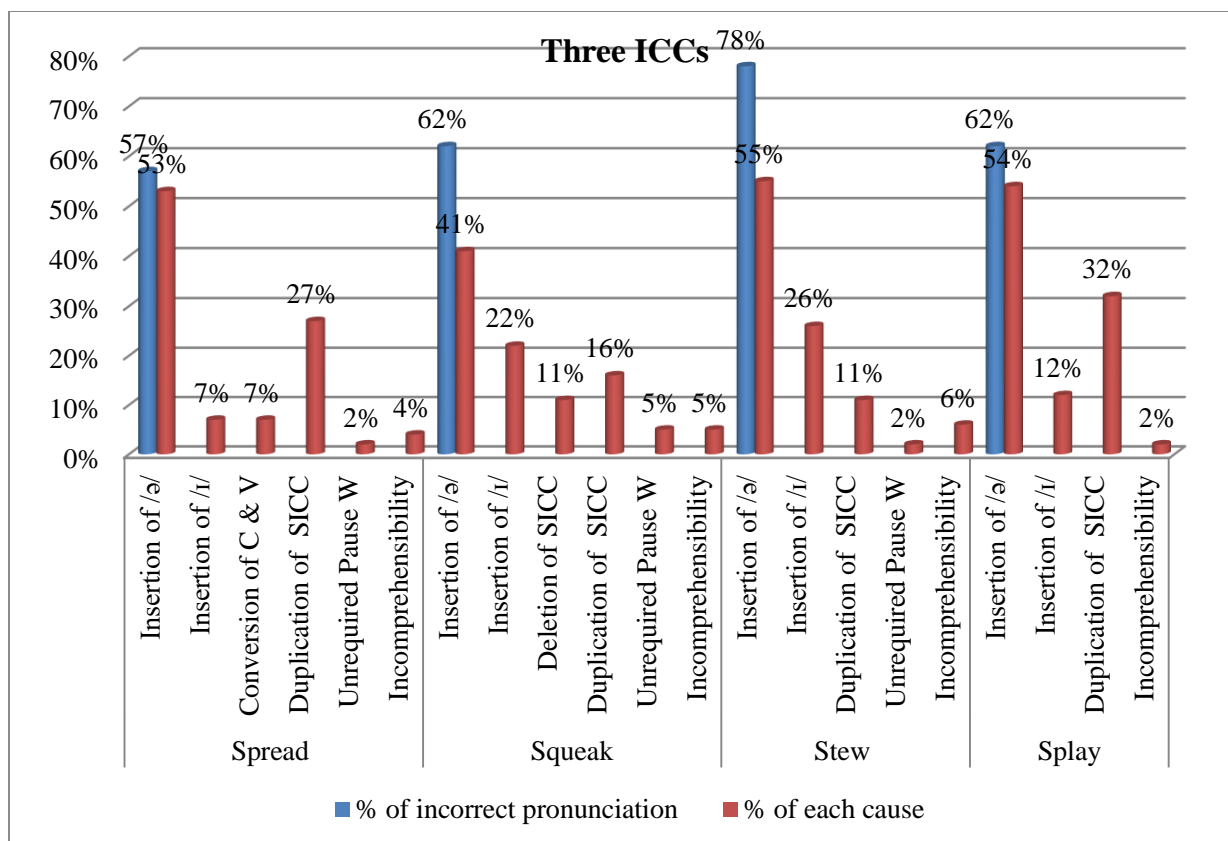
**Figure 4.9** Percentage of each cause of the incorrect pronunciation of three ICCs /s/

To answer the same questions in this section and the one in section 4.3 bellow, the researcher formulates the following interview questions:

a. *To what extent do you think Sudanese EFL undergraduates have pronunciation problems with ICCs and FCCs?*

Regarding this interview question, all participants (eight university instructors) think that many Sudanese EFL undergraduates face tremendous problems pronouncing English words involving ICCs and FCCs. Conforming that Sudanese EFL undergraduates encounter a real challenge pronouncing English words involving ICCs and FCCs, one participant says:

The Sudanese EFL undergraduates have many problems in case of pronunciation because the secondary schools have no specific courses which concern with the material of pronunciation. Moreover, instructors (in both basic and secondary schools) pay no attention to pronunciation and phonetics especially ICCs and FCCs.

8. *What are the causes of the incorrect pronunciation of English words involving ICCs and FCCs?*

Although all participants assert that most Sudanese EFL undergraduates face problems pronouncing CCs, only six of them know what are their particular problems in pronouncing CCs. three of them mention that the problem is inserting a vowel sound to break the sequence of CCs while the other three mention that the problems are vowel insertion and consonant deletion. One participant from the first group says "The main problem is being unable to pronounce ICCs and FCCs without inserting a vowel within the ICCs and FCCs." Another participant from the other group says "Students tend to use different strategies to make their pronunciation easier. For example, in ICCs most students tend to insert vowels and in FCCs they tend to delete consonants."

## 4.3 Analysis and Results of Research Question Two and Three

2. *To what extent do Sudanese EFL undergraduates understand and master English phonotactics of syllable structure involving FCCs?*
3. *What are the causes of the incorrect pronunciation of English words involving ICCs and FCCs as performed by Sudanese EFL undergraduates?*

English FCCs are divided into three types; two, three and four FCCs (see section 2.7.5). To that end, the results and discussion are presented and discussed according to the previously mentioned types and order.

At this point, and before presenting and discussing the results of FCCs, it is advantageous to point out that the answers for question two are gathered from three instruments; the two tests and interview while question three is only gathered through the word-list reading test.

For general overview see table 4.14 bellow which illustrates the mean, mode, SD, minimum, maximum, MD and sig. score of the correct and incorrect answer of the pseudo-word test and correct and incorrect pronunciation of the word-list reading test for all FCCs.

**Table 4.14** General statistics of FCCs in both pseudo-word and word-list reading tests

| Statistics | Pseudo-word Test | | | | | | Word-list Reading Test | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Two FCCs | | Three FCCs | | Four FCCs | | Two FCCs | | Three FCCs | | Four FCCs | |
| | CA | IA | CA | IA | CA | IA | CP | IP | CP | IP | CP | IP |
| **Mean** | 9.41 | 5.54 | 3.51 | 2.46 | 1.18 | 1.83 | .95 | 3.03 | .38 | 3.48 | .07 | 3.93 |
| **Mode** | 10 | 5 | 4 | 4 | 1 | 2 | 0 | 4 | 0 | 4 | 0 | 4 |
| **SD** | 2.085 | 2.095 | 1.227 | 1.20 | 0.770 | 0.76 | .928 | .974 | .643 | .911 | .252 | .252 |
| **Minimum** | 4 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 3 |
| **Maximum** | 14 | 11 | 6 | 5 | 3 | 3 | 3 | 4 | 2 | 4 | 1 | 4 |
| **MD** | -5.590 | | -3.540 | | -1.82 | | -3.050 | | -3.617 | | -3.933 | |
| **Sig.** | 0.000 | | 0.000 | | 0.000 | | 0.000 | | 0.000 | | 0.000 | |

## 4.3.1 Analysis and Analysis of Two FCCs

The results of the pseudo-word test of two FCCs as illustrated in table 4.15 below demonstrates that the mean score of the incorrect answer is significantly lower than the correct one which is basically acceptable but as compared to the MD (-5.590), there is a great difference between the correct and incorrect answer, which is also higher than sig level (0.000) that is hypothesised by the current study. This hypothesis assumes that all participants should answer the 5 pseudo-words correctly as potentially possible or impossible English words and the MD is supposed to be (0.000) not (-5.590).

**Table 4.15** Mean score of the correct and incorrect answers of two FCCs

| Statistics | Correct answer | Incorrect answer |
|:---:|:---:|:---:|
| Mean | 9.41 | 5.54 |
| Mode | 10 | 5 |
| SD | 2.085 | 2.095 |
| Minimum | 4 | 1 |
| Maximum | 14 | 11 |
| MD | -5.590 | |
| Sig. | 0.000 | |

As illustrated in table 4.16 below the least score of the correct and incorrect answer of the pseud-word test of two FCCs is 4 and 1 which are scored by 1 participant for each respectively and the highest score is 14 and 11 which are also scored by 1 participant for each respectively. 2 participants miss 3 words; 1 participant misses 1 word and another participant misses 2 words.

**Table 4.16** Frequency of correct, incorrect answer and missing value of two FCCs

| Correct answer | | Incorrect answer | | Missing value | |
|---|---|---|---|---|---|
| **Score** | **Frequency** | **Score** | **Frequency** | **Score** | **Frequency** |
| 4 | 1 | 1 | 1 | 0 | 98 |
| 5 | 3 | 2 | 5 | 1 | 1 |
| 6 | 5 | 3 | 11 | 2 | 1 |
| 7 | 10 | 4 | 16 | | |
| 8 | 14 | 5 | 19 | | |
| 9 | 15 | 6 | 17 | | |
| 10 | 19 | 7 | 13 | | |
| 11 | 17 | 8 | 9 | | |
| 12 | 11 | 9 | 5 | | |
| 13 | 4 | 10 | 3 | | |
| 14 | 1 | 11 | 1 | | |

Figure 4.10a and 4.10b below show a significant difference between the correct and incorrect answer of pseudo-words involving two FCCs in percentage. In 2 pseudo-words the participants score 82% out of 15, in 5 words they score between 65% and 78% and in 5 words they score between 58% and 64 and 3 words they score between 34% and 37%. From this figure, it is noticeable that the highest percentage of CA is 82% in the pseud-words *'manch' and *'lind' and the least is 34% in *'eadze'.

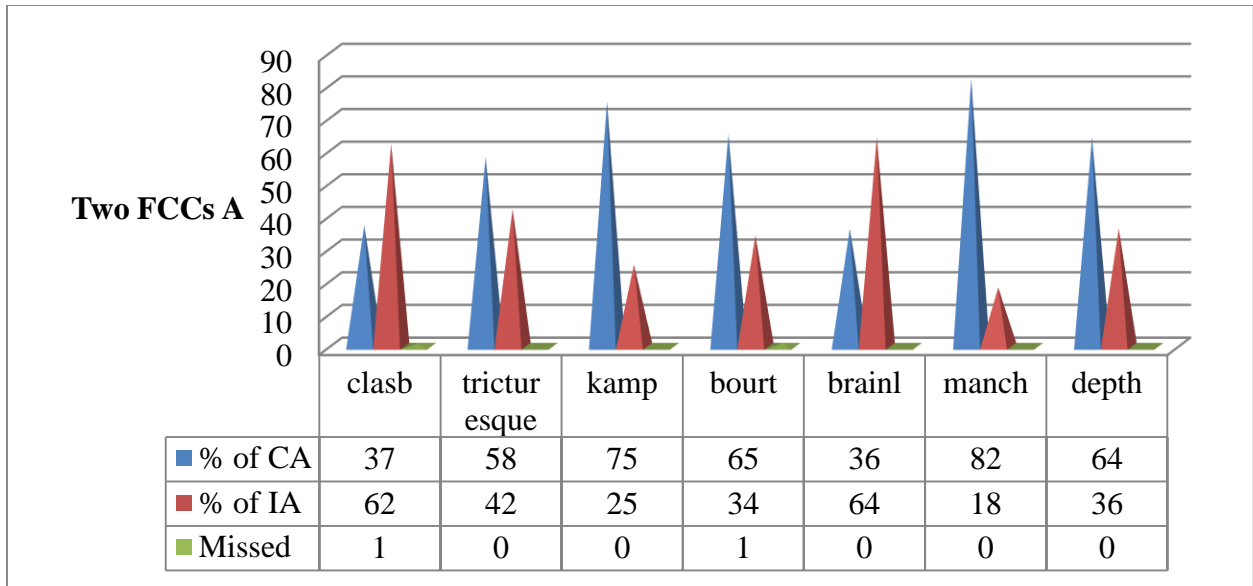| Two FCCs A | clasb | trictur esque | kamp | bourt | brainl | manch | depth |
|---|---|---|---|---|---|---|---|
| ■ % of CA | 37 | 58 | 75 | 65 | 36 | 82 | 64 |
| ■ % of IA | 62 | 42 | 25 | 34 | 64 | 18 | 36 |
| ■ Missed | 1 | 0 | 0 | 1 | 0 | 0 | 0 |

**Figure 4.10a** Percentage of correct, incorrect and missed answer of two FCCs (divided into two figures for the sake of organisation)
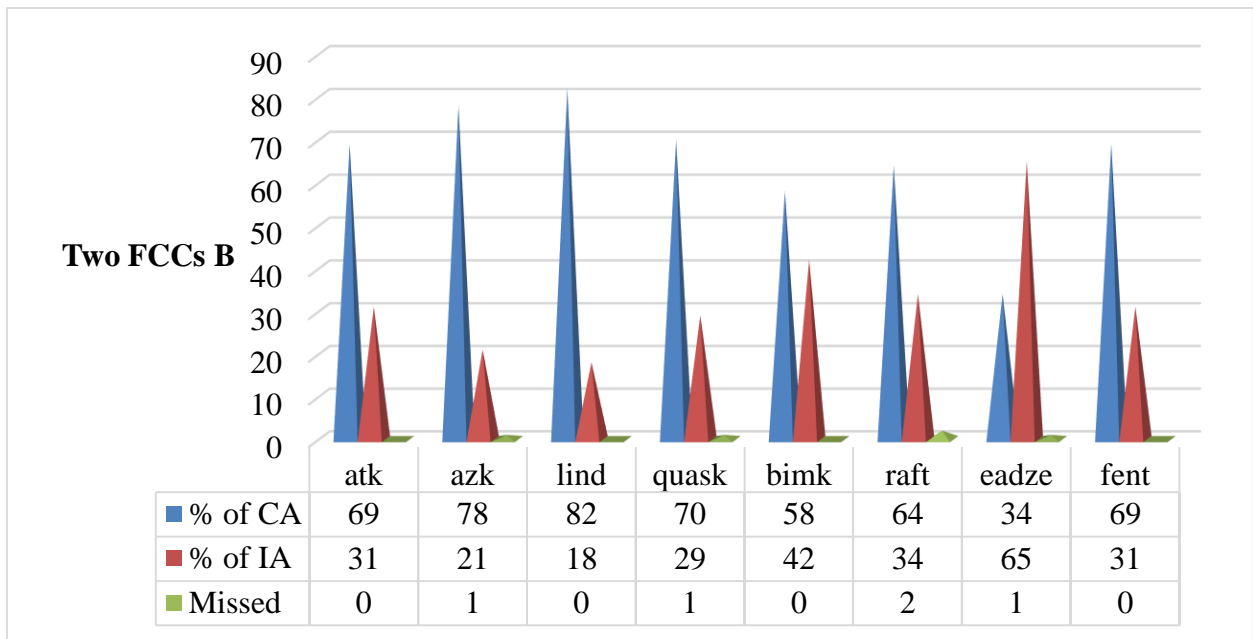
*CA= correct answer *IA= incorrect answer



| Two FCCs B | atk | azk | lind | quask | bimk | raft | eadze | fent |
|---|---|---|---|---|---|---|---|---|
| ■ % of CA | 69 | 78 | 82 | 70 | 58 | 64 | 34 | 69 |
| ■ % of IA | 31 | 21 | 18 | 29 | 42 | 34 | 65 | 31 |
| ■ Missed | 0 | 1 | 0 | 1 | 0 | 2 | 1 | 0 |

**Figure 4.10b** Percentage of correct, incorrect and missed answer of two FCCs

*CA= correct answer *IA= incorrect answer

According to table 4.17 below which shows the results of the word-list reading test of two FCCs, the mean score of the correct answer (.95) is significantly lower than the incorrect one (3.03) which is apparent from the MD (-3.050). This MD is also higher than the sig level (0.000) hypothesised by the researcher who assumes that all participants should pronounce the 4 words correctly and the MD is supposed to be (0.000) not (-3.050).

**Table 4.17** Mean score of correct and incorrect pronunciation of two FCCs

| Statistics | Correct pronunciation | Incorrect pronunciation |
|---|---|---|
| Mean | .95 | 3.03 |
| Mode | 0 | 4 |
| SD | .928 | .974 |
| Minimum | 0 | 1 |
| Maximum | 3 | 4 |
| MD | -3.050 | |
| Sig. | 0.000 | |

As illustrated in table 4.18 below the least score of the correct and incorrect pronunciation of the word-list reading test of two FCCs is 0 and 1 which are scored by 23 and 4 participants respectively and the highest score is 3 and 4 which are also scored by 4 and 23 participants respectively.

**Table 4.18** Frequency of correct and incorrect pronunciation of two FCCs

| Correct pronunciation | | Incorrect pronunciation | |
|---|---|---|---|
| Score | Frequency | Score | Frequency |
| 0 | 23 | 1 | 4 |
| 1 | 21 | 2 | 12 |
| 2 | 12 | 3 | 21 |
| 3 | 4 | 4 | 23 |
| **Total** | **60** | **Total** | **60** |

Figure 4.11 below shows a statistically significant difference between the correct and incorrect pronunciation of English word involving two FCCs. The results indicate that more than 55% of the participants fail to correctly pronounce all words. In the first word, only 20% of participants are able to pronounce the word 'stopped' correctly, in the second word 45% of the participants are able to correctly pronounce the word 'strength', in the fourth word only 25% of the participant correctly pronounce the word kept while only 5% are able to pronounce the word 'bulge. From this figure, it is noticeable that the highest percentage of CP is 45% in the word 'strength' and the least is 5% in 'bulge'.

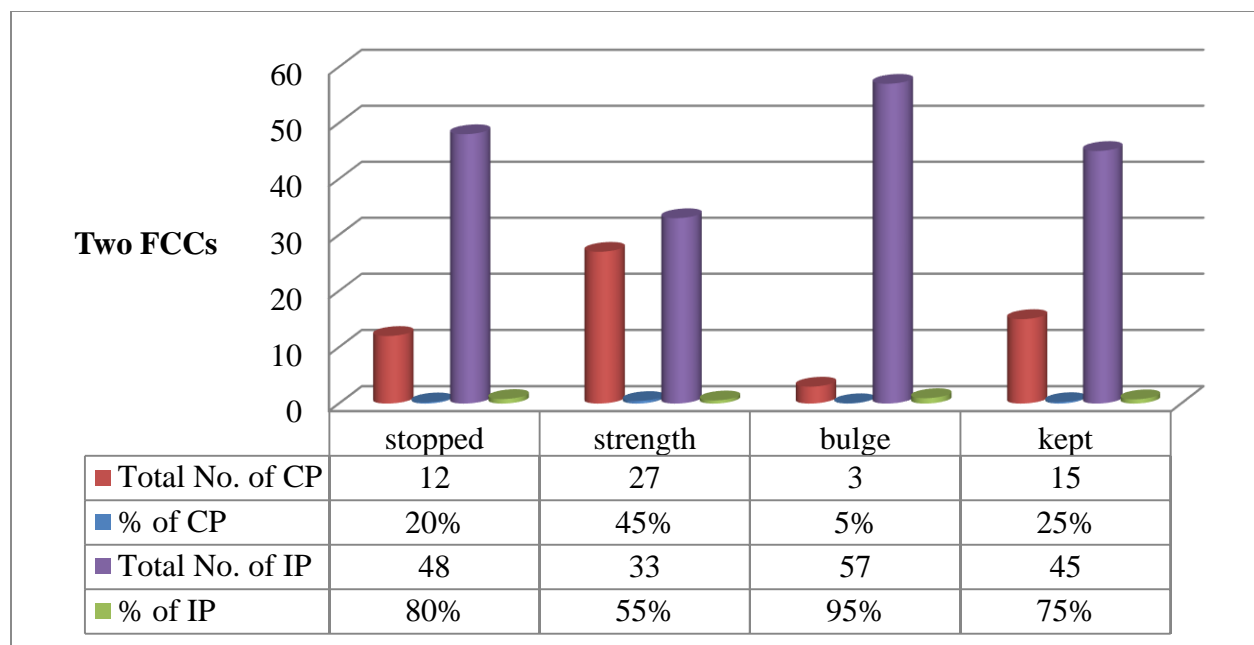| Two FCCs | | stopped | strength | bulge | kept |
|---|---|---|---|---|---|
| ■ Total No. of CP | | 12 | 27 | 3 | 15 |
| ■ % of CP | | 20% | 45% | 5% | 25% |
| ■ Total No. of IP | | 48 | 33 | 57 | 45 |
| ■ % of IP | | 80% | 55% | 95% | 75% |

**Figure 4.11** Total number and percentage of two FCCs correct and incorrect pronunciation

As shown in figure 4.12 below the major reason of the incorrect pronunciation of the word 'stopped' is caused by inserting a high front short vowel /ɪ/, deletion of SFCC*, unrequired pause O, unrequired pause W replacement of C, inserting a mid centre short vowel /ə/ and incomprehensibility. The percentages are 33%, 21%, 21%, 14%, 7%, 3% and 1% respectively for each cause. It also shows that the incorrect pronunciation of the word 'strength' is caused by replacement of C, unrequired pause O, deletion of SFCC, incomprehensibility, unrequired pause W, inserting a mid centre short vowel /ə/, inserting a vowel /ɪ/ and deletion of FiFCC*. The percentage of each cause is 34%, 20%, 15%, 12%, 7%, 5%, 5% and 2% respectively. The incorrect pronunciation of the word 'bulge' is caused by conversion of C and V position, replacement of C, incomprehensibility, unrequired pause W, inserting a mid centre short vowel /ə/, inserting a high front short vowel /ɪ/, unrequired pause O and deletion of SFCC. The percentages are 38%, 38%, 10%, 7%, 2%, 2%, 2% and 1% respectively. The last word of this group is 'kept',

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and its incorrect pronunciation is caused by unrequired pause O, inserting a mid centre short vowel /ə/, deletion of SFCC, incomprehensibility, and replacement of C. The percentage of each cause is 91% and 2% for the rest respectively. From this figure, it is noticeable that the insertion of the mid centre short vowel /ə/, deletion of SFCC, unrequired pause O, comprehensibility and replacement of C are repeated in each word and insertion a high front short vowel /ɪ/ and unrequired pause W in three words and the highest percentage is scored with unrequired pause O (72%) in the word 'kept'.

*Hence, FiFCC and SFCC stand for first FCC and second FCC.

Again, it is important to point that the incorrect pronunciation of one word may be due to more than one cause. See appendix F2 for more clarification of the Praat analysis, transcription and results of each word for each participant.
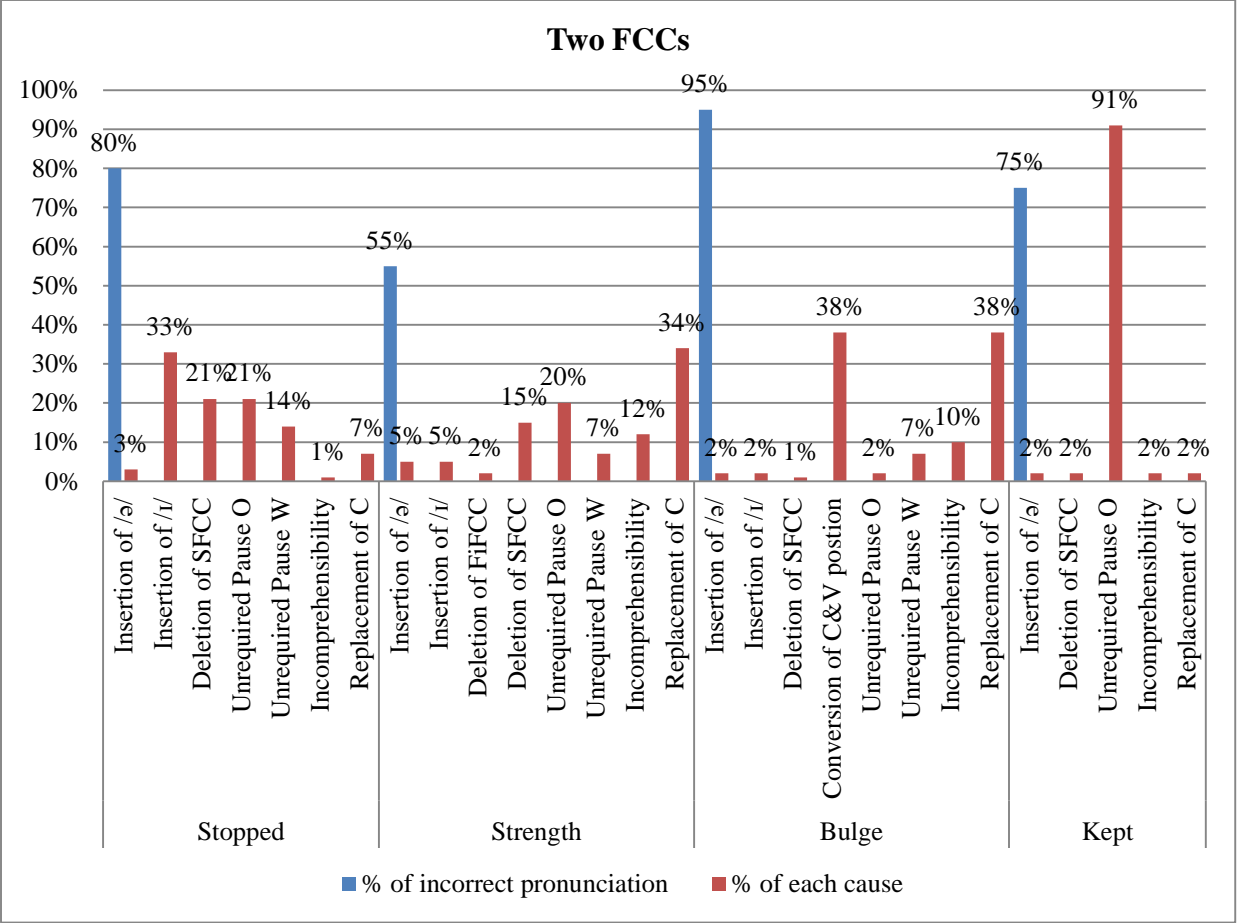
**Figure 4.12** Percentage of each cause of the incorrect pronunciation of two FCCs

## 4.3.2 Analysis and Results of Three FCCs

The results of the pseudo-word test of three FCCs as illustrated in table 4.19 below demonstrates that the mean score of the incorrect answer is lower than the correct one as compared to the MD (-3.540), there is a great difference between the correct and incorrect answer, which is also higher than sig level (0.000) which is hypothesised by the current study. This hypothesis assumes that all participants should answer the 6 pseudo-words correctly as potentially possible or impossible English words and the MD is supposed to be (0.000) not (-3.550).

**Table 4.19** Mean score of the correct and incorrect answers of three FCCs

| Statistics | Correct answer | Incorrect answer |
|---|---|---|
| Mean | 3.51 | 2.46 |
| Mode | 4 | 4 |
| Std. Deviation | 1.227 | 1.20 |
| Minimum | 1 | 0 |
| Maximum | 6 | 5 |
| MD | -3.540 | |
| Sig. | 0.000 | |

As illustrated in table 4.20 below the least score of the correct and incorrect answer of the pseud-word test of thee FCCs is 1 and 0 which are scored by 7 and 4 participants respectively and the highest score is 6 and 5 which are also scored by 7 and 6 participants respectively. 4 participants miss 1 word.

**Table 4.20** Frequency of correct, incorrect answer and missing value of three FCCs

| Correct answer | | Incorrect answer | | Missing value | |
|---|---|---|---|---|---|
| Score | Frequency | Score | Frequency | Score | Frequency |
| 1 | 7 | 0 | 4 | 0 | 96 |
| 2 | 12 | 1 | 18 | 1 | 4 |
| 3 | 29 | 2 | 30 | | |
| 4 | 31 | 3 | 30 | | |
| 5 | 14 | 4 | 12 | | |
| 6 | 7 | 5 | 6 | | |

Figure 4.13 below shows a significant difference between the correct and incorrect answer of pseudo-words involving three FCCs in percentage. In 3 pseudo-words the participants score between 64 and 75% out of 6, in 2 words they score 50% and 58% and in 1 word they score 41%. From this figure, it is noticeable that the

highest percentage of CA is 75% in the pseud-words *'amainst' and the least is 40% in *'clask'.



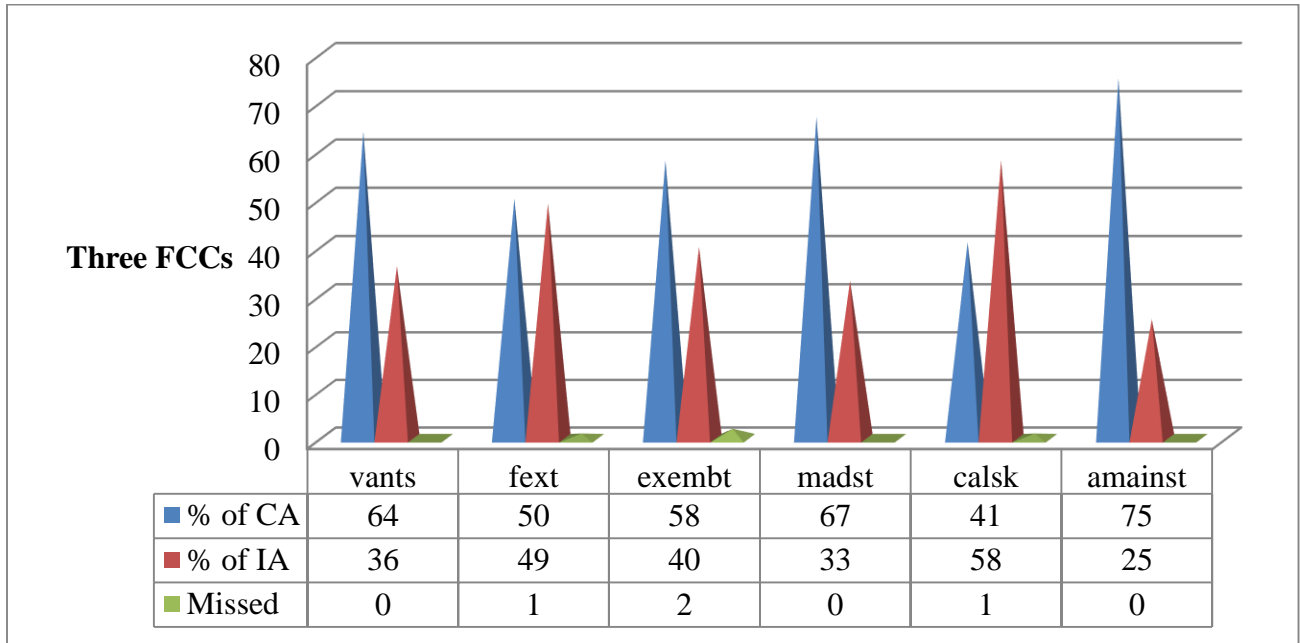| Three FCCs | vants | fext | exembt | madst | calsk | amainst |
|---|---|---|---|---|---|---|
| ■ % of CA | 64 | 50 | 58 | 67 | 41 | 75 |
| ■ % of IA | 36 | 49 | 40 | 33 | 58 | 25 |
| ■ Missed | 0 | 1 | 2 | 0 | 1 | 0 |

**Figure 4.13** Percentage of correct, incorrect and missed answer of three FCCs

*CA= correct answer *IA= incorrect answer

According to table 4.21 below which shows the results of the word-list reading test of three FCCs, the mean score of the correct answer (.38) is significantly lower than the incorrect one (3.48) which is apparent from the MD (-3.617). This MD is also higher than the sig level (0.000) hypothesised by the researcher who assumes that all participants should pronounce the 4 words correctly and the MD is supposed to be (0.000) not (-3.617).

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**Table 4.21** Frequency of correct, incorrect pronunciation and missing value of three FCCs

| Statistics | Correct pronunciation | Incorrect pronunciation |
|---|---|---|
| Mean | .38 | 3.48 |
| Mode | 0 | 4 |
| SD | .643 | .911 |
| Minimum | 0 | 2 |
| Maximum | 2 | 4 |
| MD | -3.617 | |
| Sig. | 0.000 | |

As illustrated in table 4.22 below the least score of the correct and incorrect pronunciation of the word-list reading test of three FCCs is 0 and 2 which are scored by 42 and 5 participants respectively and the highest score is 2 and 4 which are also scored by 5 and 42 participants respectively.

**Table 4.22** Frequency of correct and incorrect pronunciation of three FCCs

| Correct pronunciation | | Incorrect pronunciation | |
|---|---|---|---|
| Score | Frequency | Score | Frequency |
| 0 | 42 | 2 | 5 |
| 1 | 13 | 3 | 13 |
| 2 | 5 | 4 | 42 |
| Total | 60 | Total | 60 |

Figure 4.14 below shows a statistically significant difference between the correct and incorrect pronunciation of English word involving three FCCs. The results indicate that more than 83% of the participants fail to correctly pronounce all words. In the first, second and fourth words, students face much problem in pronouncing the words 'asked', 'fifths' and 'exempt' in which only 3%, 8% and 10% of the total 60 participants pronounce these words correctly, while in the third word only 17% of the participants are able to correctly pronounce the word 'midst'. From this figure, it is noticeable that the highest percentage of CP is 17% in the word 'midst' and the least is 3% in 'asked'. It is also advantageous to mention that this is the most crucial cluster to be mastered by Sudanese EFL undergraduates so far as the results show.



| Three FCCs | asked | fifths | midst | exempt |
|---|---|---|---|---|
| ■ Total No. of CP | 2 | 5 | 10 | 4 |
| ■ % of CP | 3% | 8% | 17% | 10% |
| ■ Total No. of IP | 58 | 55 | 50 | 56 |
| ■ % of IP | 97% | 92% | 83% | 90% |
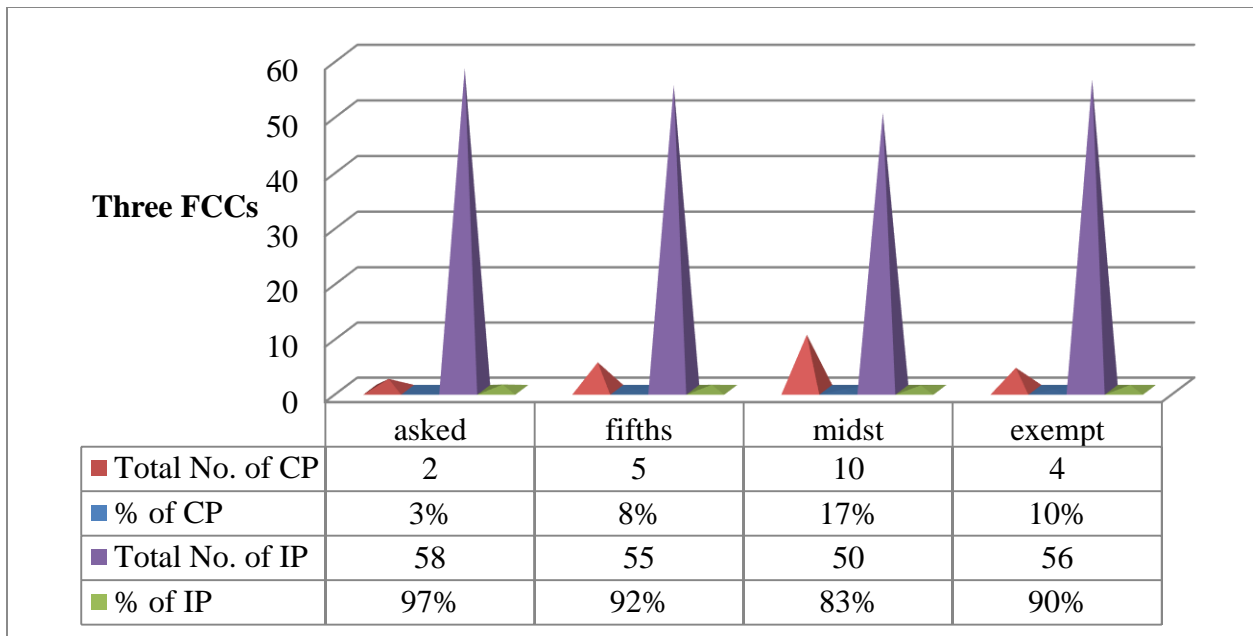
**Figure 4.14** Total number and percentage of three FCCs correct and incorrect pronunciation

As shown in figure 4.15 below the major reason of the incorrect pronunciation of the word 'asked' is caused by deleting the TFCC*, inserting a high front short

vowel /ɪ/, unrequired pause W, unrequired pause O, replacing a C, deleting the SFCC, duplicating the SFCC, inserting a mid centre short vowel /ə/ and inserting a mid-low front short vowel /e/. The percentages are 23%, 19%, 18%, 13%, 13%, 6%, 5%, 2% and 1% respectively for each cause. It also shows that the incorrect pronunciation of the word 'fifths' is caused by deleting the TFCC, deleting the SFCC, unrequired pause W, incomprehensibility, replacing a C, inserting a mid centre short vowel /ə/, inserting a vowel /ɪ/ and inserting a mid-low front short vowel /e/. The percentage of each cause is 58%, 18%, 10%, 5%, 5%, 2%, 2% and 2% respectively. The incorrect pronunciation of the word 'midst' is caused by deleting the TFCC, inserting a mid centre short vowel /ə/, unrequired pause W, deleting the FiFCC, unrequired pause O, incomprehensibility and inserting a high front short vowel /ɪ/. The percentages are 32%, 24%, 16%, 13%, 8%, 5% and 3% respectively. The last word of this group is 'exempt', and its incorrect pronunciation is caused by deleting the SFCC, unrequired pause W, incomprehensibility, unrequired pause O, inserting a mid-low front short vowel /e/, inserting a mid centre short vowel /ə/, deleting the FiFCC, inserting a high front short vowel /ɪ/, and deleting the TFCC. The percentage of each cause is 34% 33%, 12%, 6%, 5%, 4%, 4%, 2% and 1% respectively. From this figure, it is noticeable that the insertion of the mid centre short vowel /ə/, insertion a high front short vowel /ɪ/, deletion of TFCC and unrequired pause W are repeated in each word and insertion of /e/, deletion of SFCC and unrequired pause O in three words and the highest percentage is scored with the deletion of TFCC (58%) in the word 'fifths'.

*Hence, TFCC stands for third FCC.

Again, it is important to point that the incorrect pronunciation of one word may be due to more than one cause. See appendix F2 for more clarification of the Praat analysis, transcription and results of each word for each participant.
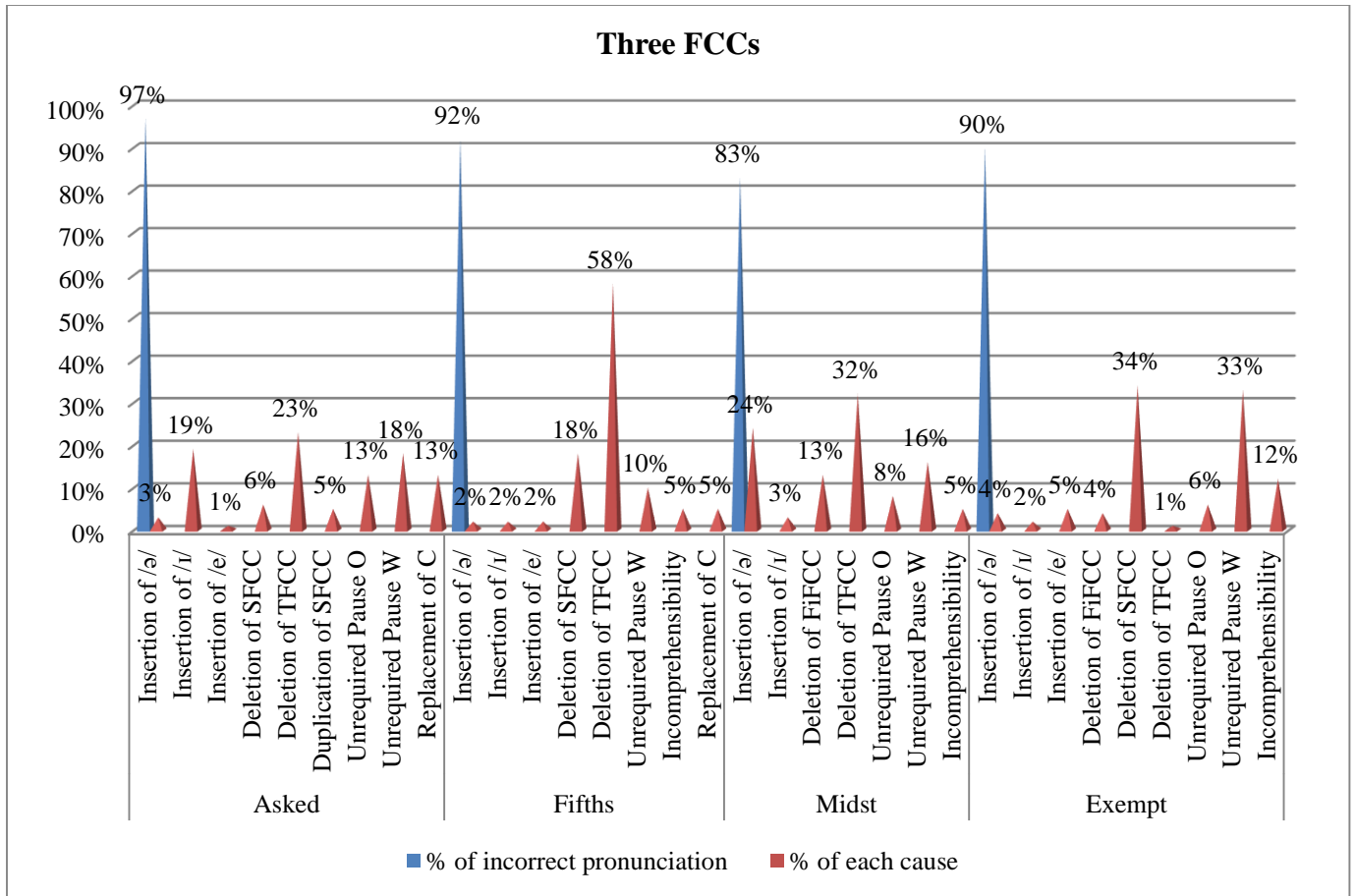
**Figure 4.15** Percentage of each cause of the incorrect pronunciation of three FCCs

## 4.3.3 Analysis and Results of Four FCCs

The results of the pseudo-word test of four FCCs as illustrated in table 4.23 below demonstrates that the mean score of the incorrect answer is lower than the correct one which is basically acceptable but as compared to the MD (-1.82), there is a difference between the correct and incorrect answer, which is also higher than sig level (0.000) that is hypothesised by the current study. This hypothesis assumes that all participants should answer the 3 pseudo-words correctly as potentially possible or impossible English words and the MD is supposed to be (0.000) not (-1.82).

**Table 4.23** Mean score of the correct and incorrect answers of four FCCs

| Statistics | Correct answer | Incorrect answer |
|---|---|---|
| Mean | 1.18 | 1.83 |
| Mode | 1 | 2 |
| Std. Deviation | 0,770 | 0.76 |
| Minimum | 0 | 0 |
| Maximum | 3 | 3 |
| MD | -1.82 | |
| Sig. | 0.000 | |

As illustrated in table 4.24 below the least score of the correct and incorrect answer of the pseud-word test of four FCCs is 0 for both which is scored by 20 and 2 participants respectively and the highest score is 3 for both which is also scored by 2 and 20 participants respectively.

**Table 4.24** Frequency of correct, incorrect answer and missing value of four FCCs

| Correct answer | | Incorrect answer | | Missing value | |
|---|---|---|---|---|---|
| Score | Frequency | Score | Frequency | Score | Frequency |
| 0 | 20 | 0 | 2 | 0 | 100 |
| 1 | 44 | 1 | 33 | | |
| 2 | 34 | 2 | 45 | | |
| 3 | 2 | 3 | 20 | | |

Figure 4.16 below shows a statistically significant difference between the correct and incorrect answer of pseudo-words involving four FCCs. In the first pseudo-word the participants score 29% out of 3 and in the second and third words they score between 39% and 49%. From this figure, it is noticeable that the highest percentage of CA is 49% in the pseud-word *'antiplms' and the least is 29% in *'glimbsed'.
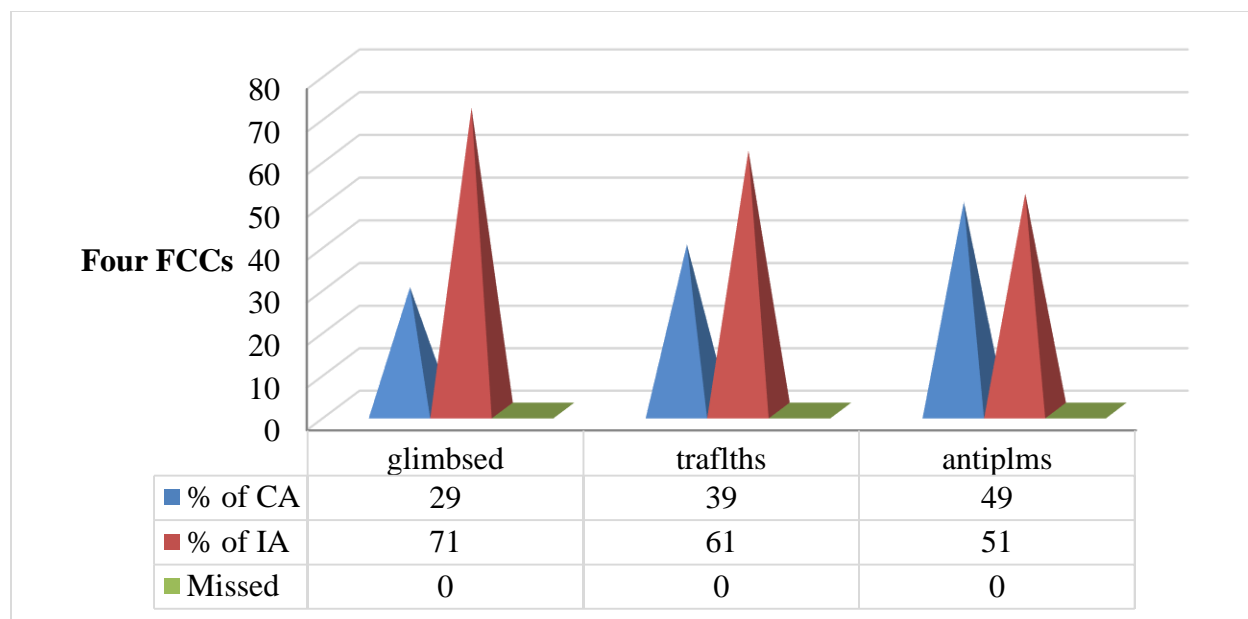
**Figure 4.16** Percentage of correct, incorrect and missed answer of four FCCs

*CA= correct answer *IA= incorrect answer

According to table 4.25 below which shows the results of the word-list reading test of four FCCs, the mean score of the correct answer (.07) is significantly lower than the incorrect one (3.93) which is apparent from the MD (-3.933). This MD is also higher than the sig level (0.000) hypothesised by the researcher who assumes that all participants should pronounce the 4 words correctly and the MD is supposed to be (0.000) not (-3.933).

**Table 4.25** Frequency of correct, incorrect pronunciation and missing value of four FCCs

| Statistics | Correct pronunciation | Incorrect pronunciation |
|---|---|---|
| Mean | .07 | 3.93 |
| Mode | 0 | 4 |

| | | |
|---|---|---|
| **SD** | .252 | .252 |
| **Minimum** | 0 | 3 |
| **Maximum** | 1 | 4 |
| **MD** | -3.933 | |
| **Sig.** | 0.000 | |

As illustrated in table 4.26 below the least score of the correct and incorrect pronunciation of the word-list reading test of four FCCs is 0 and 3 which are scored by 56 and 4 participants respectively and the highest score is 1 and 3 which are also scored by 4 and 56 participants respectively.

**Table 4.26** Frequency of correct and incorrect pronunciation of four FCCs

| Correct pronunciation | | Incorrect pronunciation | |
|---|---|---|---|
| **Score** | **Frequency** | **Score** | **Frequency** |
| 0 | 56 | 3 | 4 |
| 1 | 4 | 4 | 56 |
| **Total** | 60 | **Total** | 60 |

Figure 4.17 below shows a statistically significant difference between the correct and incorrect pronunciation of English word involving four FCCs. The results indicate that more than 95% of the participants fail to correctly pronounce all words. In the second and fourth words, all participants (0%) face fail to correctly pronounce the words 'thousandths' and 'sixths', while in the third word only 2% of the participants are able to correctly pronounce the word 'texts' and 5% the word 'glimpsed'. From this figure, it is noticeable that the highest percentage of CP is 5% in the word 'glimpsed' and the least is 0% in 'thousandths' and 'sixths'. Again as compared to all types of English CCs, it is clear that the most crucial CCs for

Sudanese EFL undergraduates is four FCCs in which the results show that 95% of the participants fail to correctly pronounce these words and in some words the whole participants fail. With no doubt, this result indicates that Sudanese EFL undergraduates do not master the pronunciation of English words involving four FCCs.
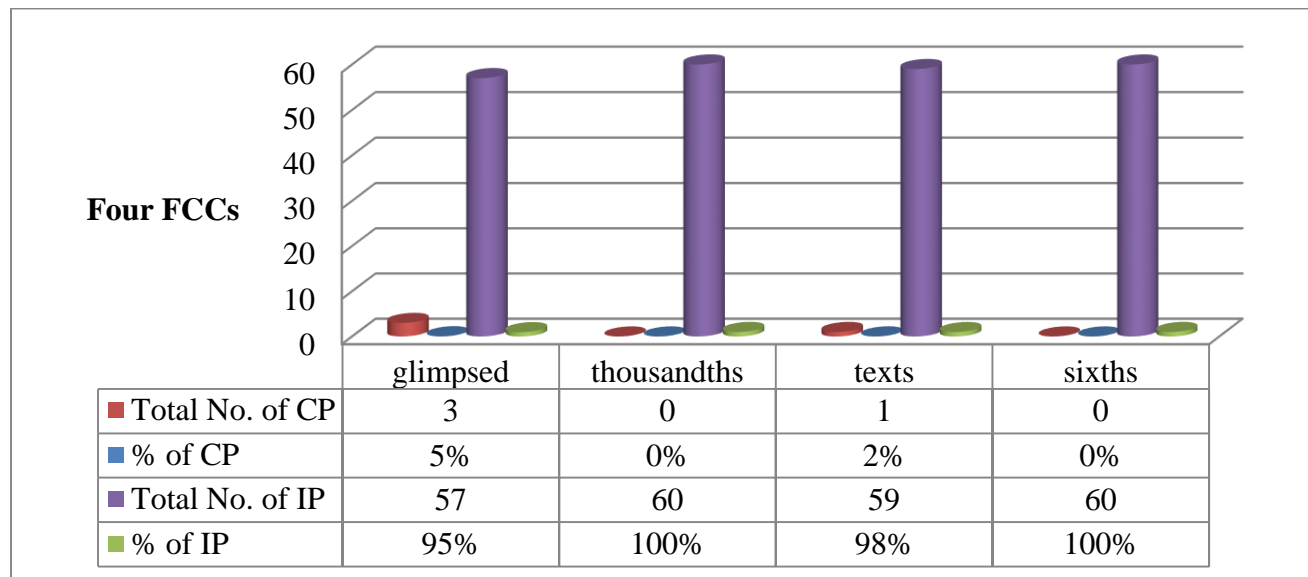


| **Four FCCs** | glimpsed | thousandths | texts | sixths |
|---|---|---|---|---|
| ■ Total No. of CP | 3 | 0 | 1 | 0 |
| ■ % of CP | 5% | 0% | 2% | 0% |
| ■ Total No. of IP | 57 | 60 | 59 | 60 |
| ■ % of IP | 95% | 100% | 98% | 100% |

**Figure 4.17** Total number and percentage of four FCCs correct and incorrect pronunciation

As shown in figure 4.18 below the major reason of the incorrect pronunciation of the word 'glimpsed' is caused by inserting a mid centre short vowel /ə/, unrequired pause W, deleting the FoFCC*, deleting the SFCC, inserting a high front short vowel /ɪ/, inserting a mid-low front short vowel /e/, unrequired pause O, deleting the SFCC, incomprehensibility and replacing a C. The percentages are 27%, 21%, 17%, 16%, 6%, 5%, 3%, 2%, 2% and 2% respectively for each cause. It also shows that the incorrect pronunciation of the word 'thousandths' is caused by deleting the SFCC, deleting the FoFCC, incomprehensibility, deleting TFCC, replacing a C, inserting a mid centre short vowel /ə/ and unrequired pause W. The percentage of

each cause is 38%, 38%, 12%, 7and, 3%, 1% and 1% respectively. The incorrect pronunciation of the word 'texts' is caused by deleting the FoFCC, inserting a mid centre short vowel /ə/, deleting the TFCC, unrequired pause W, inserting a high front short vowel /ɪ/, unrequired pause O, incomprehensibility, deleting the FiFCC and deleting the SFCC. The percentages are 30%, 23%, 20%, 12%, 8%, 2%, 2%, 1% and 1% respectively. The last word of this group is 'sixths', and its incorrect pronunciation is caused by deleting the FoFCC, deleting the TFCC, inserting a mid centre short vowel /ə/, duplicating the FiFCC, incomprehensibility, deleting SFCC, unrequired pause W, inserting a high front short vowel /ɪ/, deleting FiFCC, and unrequired pause O. The percentage of each cause is 29% 16%, 13%, 12%, 9%, 7%, 7%, 3%, 1% and 1% respectively. From this figure, it is noticeable that the insertion of the mid centre short vowel /ə/, deleting the SFCC, deleting the TFCC, deleting the FoFCC, unrequired pause W, and incomprehensibility are repeated in each word and insertion a high front short vowel /ɪ/, unrequired pause O in three words and the highest percentage is scored with the deletion of SFCC and deletion of FoFCC (38%) in the word 'thousandths'.

*Hence, FoFCC stands for fourth FCC.

Again, it is important to point that the incorrect pronunciation of one word may be due to more than one cause. See appendix F2 for more clarification of the Praat analysis, transcription and results of each word for each participant.
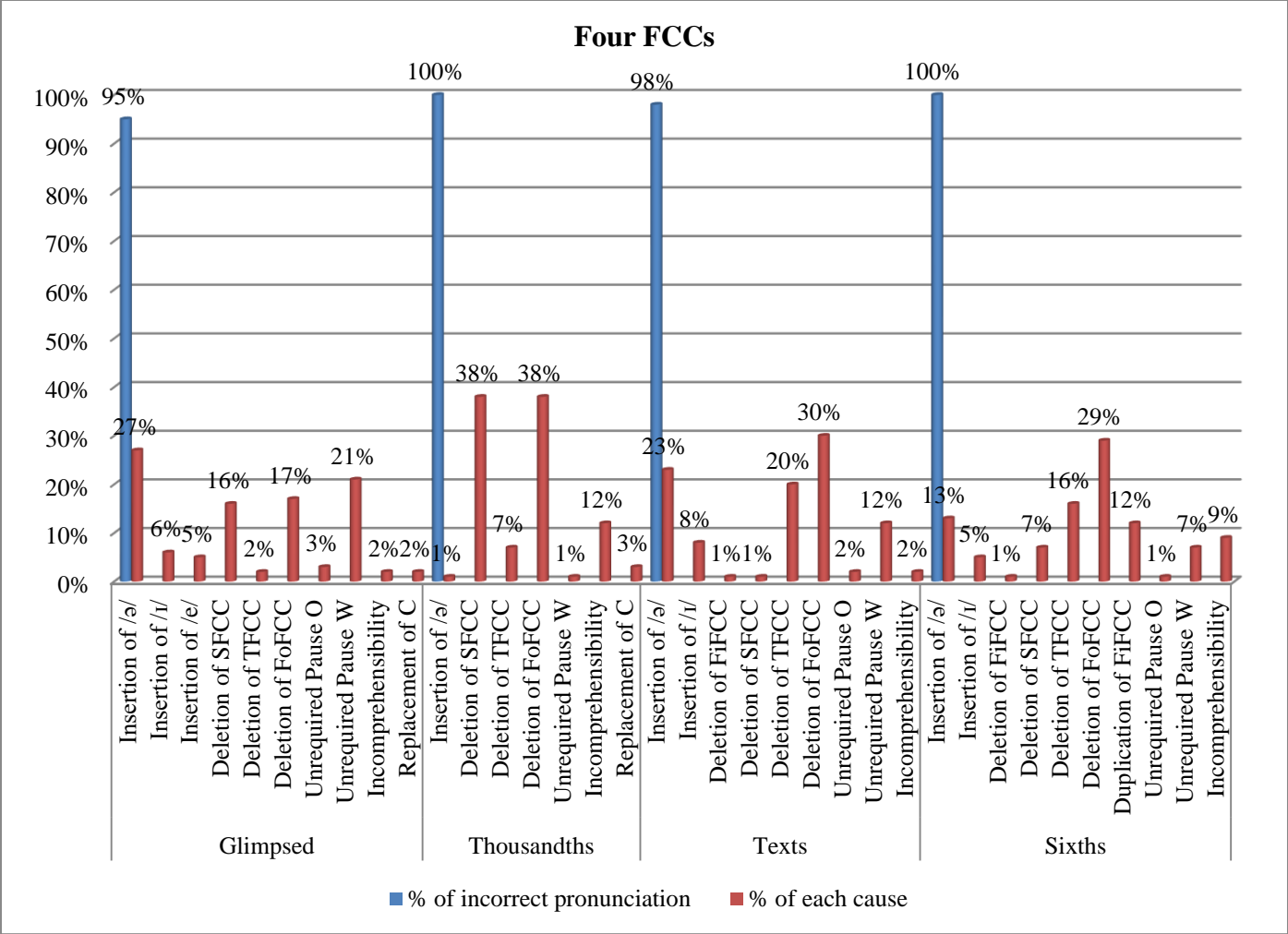
**Figure 4.18** Percentage of each cause of the incorrect pronunciation of four FCCs

## 4.4 Analysis and Results of Research Question Four

4. How effective are the methods, materials and activities used in teaching the sound system of English language to Sudanese EFL undergraduates?

This question is answered using data gathered by two instruments; an interview and observation. For the sake of unity and organisation, the data gathered through the interview is shown first then the observation checklist. And to make it straight forward, the results for the methods are going to be displayed first then the materials and finally the activities.

*1.a What are the differences between the phonotactic system of English and Arabic?*

Concerning this question, only one participant is aware of all differences between the phonotactic system of these languages regarding CCs. To quote his answer, he says:

> We have up to three CCs in the initial position and up to four consonants at the coda position. In Arabic, we have only up to two CCs and even that is found in certain occasions. For example in وقف pause في حالة الوقف على السكون this is the only case we find the CCs.

Somewhat slightly, three participants are aware that Arabic is different from English in terms of CCs i.e. all of say that Arabic language has no consonant cluster at all. For example, one participant says "Concerning CCs, it is possible to occur in English in both positions; initial and final, but this is not the case in Arabic."

Being unsure, one participant says that English has more than one CCs but in Arabic as he says "I think you might not find more than one consonant sound in Arabic but I'm not 100% sure but is not more than two initially and finally."

The rest three participants have no idea about the differences of phonotactic system of the two languages. One participant of this group says "It is difficult to say because I have no idea about the constraints of Arabic sound system".

*1.b To what extent do you acquaint your students the differences between the phonotactic system of English and Arabic?*

With respect to this question, only for out of the eight participants acquaint their students the differences as one participant says "I always tell them, I make them aware of the fact that they are actually making/facing/confronting immense difficulties in pronouncing words with CCs because actually we do not have as many CCs in Arabic as in English." Another participant from the same group says "Acquainting students with this aspect is usually dealt with broadly.

The other four participants never acquaint their students these differences because they themselves do not know the differences.

*1.c To what extent do you think being aware of these differences affect their mastery of the L2 pronunciation?*

Regarding the effect of being aware of these differences, five participants believe that being aware of the differences between the phonotactic system of your L1 and L2 affects positively the mastery of L2 pronunciation. For example, one participant says "Being aware of the differences between Arabic and English sound systems I think is important to a very high extent to students of L2 because it has a great deal of impact on their fluency and pronunciation quality." Another one says "I think being aware of phonotactic differences can affect positively the mastery of learners' language pronunciation."

Other participant thinks that being aware of these differences might help improving their spelling skill but not pronunciation as he says "It might help to improve their spelling not pronunciation."

Other participants who are two have no idea whether it affects them or no.

*4.c How do you remedy your students' pronunciation problems in pronouncing words involving ICCs and FCCs?*

Regarding the remedial strategy followed by the participants so as to improve their students' pronunciation of ICCs and FCCs, four participants mention that they some remedial strategies to improve their students' pronunciation. For example, one participant says "I always draw their attention to the differences between the Arabic and English pronunciation and correct these mistakes for them." Another one says "Usually by giving them extra practice and authentic materials." A third one says:

> The only way to avoid this problem is by exposing the student to authentic materials and assigning them with adequate exercise (most of the time using minimal sounds and modeling the correct pronunciation) and the student should practise it more.

The rest of the participants, who are four, regarding their answer to this question two of them never apply any sort of remedial processes while the other two participants use an informal strategy to remedy these mispronunciations as one of them says "No formal remedy exercises are done. They are corrected in time when they mispronounce a word with clusters, only. The other one, who also never use remedial strategy to correct his student pronunciation, claims that the students are in a desperate need for a) direct instructions on pronunciation. b) to be seated in small classes (not more than 25 students). c) textbooks should include pronunciation. d) using good teaching aids and qualified instructors.

With respect to the data gathered by the observation checklist, the results, as illustrated in table 4. 27 bellow, show that all checklist items that indicate for the effectiveness of the teaching methods are not applied in both lectures except one item is being applied. Hence, checklist items are ordered as they appear in the original form of the observation (see appendix D for the original form).

**Table 4.27** Observation checklist results for the teaching methods

| Checklist Item | Applied | Partially Applied | Not Applied |
|---|---|---|---|
| 5. The instructor takes proactive stance to prevent possible future pronunciation problems. | | | 2 |
| 6. The instructor draws the attention of her/his students to the fact that NO Arabic word begins with two consonants. | | | 2 |
| 7. The instructor explicitly acquaints her/his students with the differences between the phonotactic system of English and their native (Arabic) language. | | | 2 |
| 12. If there are any errors or mistakes, the instructor immediately remedies them. | | | 2 |
| 13. The instructor corrects her/his students when they insert a vowel/s in two or three ICCs to avoid inserting in initial two and/or three CCs. | | | 2 |
| 14. The instructor positively motivates her/his students to attain native-like pronunciation. | | | 2 |
| 15. Students are highly willing to have a native-like accent. | | | 2 |
| 16. The instructor employs technical terms during her/his lectures. | 2 | | |

*3. How often do you use authentic audiovisual materials in teaching CCs?*

With respect to this question, six participants with varying degree of frequency from three usually to one rarely and one sometimes. three of this group of participants usually use authentic audiovisual materials as one of them says "I

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usually use videos presented by native speakers to overcome sound system difficulties."

The other two participants never use authentic audiovisual materials and this due to the lack of equipment as one participant says "Never use audiovisual materials because the lecture hall is not convenient."

Regarding the observation checklist data, as illustrated in table 4.28 bellow, and as in the previous items, all items that indicate the effectiveness of the teaching materials are not applied in both lectures.

**Table 4.28** Observation checklist results for the teaching materials

| Checklist Item | Applied | Partially Applied | Not Applied |
|---|---|---|---|
| 1.  The instructor uses authentic audible materials. | | | 2 |
| 2.  The instructor uses authentic visual materials. | | | 2 |
| 3.  The instructor provides tape recording to enable the students record their own voices. | | | 2 |
| 4.  The instructor provides the students with sound system, speakers or headphones to enable them listen to their own recordings. | | | 2 |

*2. How often do you usually give your students opportunity to practise aspects of English sound system especially CCs?*

Concerning giving students chances to practise what they are learning, six participants with varying degree of frequency from one always to three usually and one often. One participant from this group conditions the chance given to students only when there are differences between the phonotactic system of both language as she says "I enable learners to practise aspects of sound system when they

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encounter problem, especially when there is a difference with Arabic sound system."

The rest, who are two, participants never give their students opportunity to practise what they teach them and this is due to the large number of students in one class as one of them says "I'm afraid to say I do not give students chances to practice aspects of sound system and this because of the problem of having large number of students." The other one who confirms that he gives opportunity to practise what he teaches, but he never gives chance for pronunciation as quoted "It depends on the lecture. I usually give them exercises. Such as analysis; how to analyse the words; transcription and dividing the words into their constituent component of syllable but no pronunciation practice for the CCs."

With regard to the data gathered by the observation checklist to measure the effectiveness of the activities used in teaching English CCs, the results, as shown in table 4.29 bellow, indicate that, in both lectures, all checklist items are not applied at all.

**Table 4.29** Observation checklist results for the teaching activities

| Checklist Item | Applied | Partially Applied | Not Applied |
|---|---|---|---|
| 8. The instructor gives the students opportunity to practise pronouncing what s/he teaches in the class. | | | 2 |
| 9. The instructor frequently gives the students opportunity to practise pronouncing what s/he teaches in the class. | | | 2 |
| 10. The students actively participate in the pronunciation activities in the class. | | | 2 |

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| 11.More than 80 % of the students practise pronouncing what they are taught during their lecture. | | | 2 |
|---|---|---|---|

## 4.5 Analysis and Results of Research Question Five

5. To what extent do Sudanese university instructors think pronunciation learning factors (age, personality, phonetic ability, motivation, attitude, etc.) play a crucial role in the process of understanding and mastering English pronunciation?

To answer this research question, the researcher formulates the following interview questions.

*5.a How do you think age is closely related to the mastery of pronunciation?*

*5.b What is the reflection of students' age on their pronunciation?*

With respect to the relevance of age to the mastery of pronunciation, five participants confirm that age is closely related to the mastery of pronunciation and it is an effective factor for having good pronunciation as one participant says "Age is closely related to the mastery of pronunciation." another one says "I think age is an effective factor to the mastery of pronunciation."

The rest three participants believe that age has no relevance to the mastery of pronunciation as one of them says:

> Yes, usually, in the field of SLA, I think age plays a major role in mastering a foreign language in general but for pronunciation I think pronunciation is a skill that can be improved by working on it rather than age.

Another participant from the same group attributes the mastery of pronunciation to practise rather than age as he mentions "Generally speaking, age does not have much effect on mastering pronunciation it depends on practice only."

Concerning the reflection of age on students' pronunciation, the same above mentioned five participants assert that the younger the person is the better would be in pronunciation as one of them mentions "If they are younger they will get good pronunciation." under certain conditions and relying on some studies, another participant says "Many researches stated that young learners master pronunciation more hurriedly and correctly than adult learners under these conditions: a) they need more practices and activities, b) good syllabuses at early studying stages and c) qualified instructors."

Definitely, the rest three participants as in the previous answer (relevance of age to the mastery of pronunciation) believe that age has no any reflection on students' pronunciation mastery as one of them says "age has no reflection to the mastery of pronunciation."

*5.c To what extent do you think students' personality, phonetic ability, motivation and attitude play a crucial role in the process of attaining a native-like pronunciation?*

Regarding the importance of students' personality, phonetic ability, motivation and attitude as crucial factors for having good, seven participants confirm that all these factors play a crucial role as one participant mentions that these factors play an important role in acquiring a native-like pronunciation. Adding other factors such linguistic ability, one participant from this group says "I mean factors such as students' personality, self-confidence, motivation, teacher's personality himself, plays a crucial role plus some linguistic factors. All plays a crucial role." A third

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participant, confirming all the above mentioned factors except personality one participant says "Apart from personality, phonetic ability, motivation and attitude play a vital role in having a native-speaker-like pronunciation."

On the other hand, one participant claims that these factors have no much impact on attaining a native-like pronunciation believing that native-like pronunciation is an unreached level for many students as he says "Most students do not care about good pronunciation. So, we can say these factors play to some extent a considerable role in students' pronunciation. After all, attaining native-like pronunciation is far-reached level."

## 4.6 Analysis and Results of Research Question Six

6. Why do you think Sudanese EFL undergraduates fail to correctly pronounce words containing consonant clusters (ICCs or FCCs)?

Hence, the same question is utilised as the sixth and last interview question.

Providing the same answer with different words and unlike the other interview questions, all participants attributes this failure to MT interference as one participant says "Because the Arabic language (their MT) does not contain such ICCs while they rarely occur finally." Another participant recalling students' physical capability along with MT interference says "I think the difficulty – in addition to their physical construction – arises from the variation between the two sound systems; Arabic and English." A third participants says "Most Sudanese undergraduates naturally fail to pronounce some clusters especially (ICCs and FCCs) because that maybe absent in their MT language (Arabic) or they may rarely take no notice of that during their studies." One more participant says "The main reason for this failure is because of the difference between the L1 and L2"

## 4.7 General Discussion

The current study is carried out to, among other aims, identify the magnitude of Sudanese EFL undergraduates understanding and mastering of English phonotactics of words involving ICCs and FCCs. The researcher hypothesises that *'Sudanese EFL undergraduates face magnitude difficulties in understanding and mastering English phonotactics of words involving ICCs and FCCs.'* According to the results of the word-list reading test, pseudo-word test and interview, this hypothesis is proven to be true as most of the scores of both tests are more than 50% of mispronounced words and incorrect answers and all interview participants positively agree with this hypothesis. Furthermore, the mean difference between the correct and incorrect pronunciation of the word-list reading test ranges between -1.133 and -3.933 and the pseudo-word test between -1,770 and -5,590, which significantly high difference.

Bearing in mind the participants of this study are all EFL students who undertake the two tests, these results are in harmony with previous studies which show that EFL learner encounter problems in pronouncing English words with ICCs and FCCs (Gashaw, 2016; Al-Samawi, 2014; Mbha and David, 2014). One probable reason for having such problems in pronouncing English words with CCs is the different phonotactic system of both languages in which Arabic does not allow CCs as in English. It only permits two FCCs within very few words.

The third aim of this study is to explore the causes of the incorrect pronunciation of English words involving ICCs and FCCs as performed by Sudanese EFL undergraduates. To achieve this goal, the researcher hypothesises that *'Unrequired pause between consonant segments in one syllable, vowel insertion and consonant deletion are the causes of the incorrect pronunciation.'* Based on the results

obtained by the computer-based analysis using 'Praat', the data show that most of the incorrect pronunciations are caused by unrequired pause to break the sequence of consonant string in both positions; in the onset and coda. To the best knowledge of the researcher, this cause is firstly identified as a strategy used by EFL undergraduates to ease the pronunciation English words with ICCs and FCCs. It also reveals that the participants, as many other EFL students, insert an intrusive vowel to split the string of CCs. Moreover, the findings show that Sudanese EFL undergraduates delete consonant sound/s in FCCs. Finally, the results demonstrate two more causes of incorrect pronunciation which are not mentioned in this hypothesis; consonant replacement and consonant-vowel position conversion. This hypothesis is also proven by the interview in which six participants mention that the causes are vowel insertion and consonant deletion.

The findings of this study are compatible with previous studies in the general assertion that EFL students encounter difficulties in pronouncing English words with ICCs and FCCs in which they insert an epenthetic vowel (/ə/ or /ɪ/) to break the sequence CCs (Darcy and Thomas, 2019; Gashaw, 2016).

Exploring the effectiveness of the teaching methods, materials and activities used in teaching the sound system of English language to Sudanese EFL undergraduates is the fourth objective of this study. And to achieve this objective, the researcher hypothesises that *'The teaching methods, materials and activates used in teaching the sound system of English language to Sudanese EFL undergraduates are not effective for improving pronunciation skills and more particularly CCs of the students.'* According to the data gathered by the observation checklist and interview as shown in section 4.4 above, only one item out of the sixteen items is applied in teaching English phonotactics which is a great deficiency and it lacks

most of the required principles for teaching pronunciation mentioned in chapter two.

The fifth objective is to investigate Sudanese university instructors' awareness towards the importance of age, personality, phonetic ability, motivation and attitude as pronunciation learning factors in understanding and mastering English pronunciation. To reach this goal the researcher hypothesises that *'Sudanese university instructors think that age, personality, phonetic ability, motivation and attitude play a crucial role in the process of understanding and mastering English pronunciation.'* With accordance to this hypothesis, seven out of the eight participates assert that all above mentioned factors except age extremely affect the understanding and mastering of pronunciation while five of them side the theory that plays a crucial role in the endeavour to master the pronunciation of a language.

As a last hypothesis to explore the reason of Sudanese EFL undergraduates' failure to correctly pronounce words containing CCs, the researcher hypothesises that *'The reason of this failure refers to the linguistics differences between the phonotactic system of their MT and the TL.'* The results obtained by the interview and inferred from the word-list test appear to correspond with this hypothesis in which all interviewees attribute this failure to MT interference and the word-list reading test's results also indicate that this failure arise from the phonotactic differences of the two languages. This finding is closely accordant with Darcy and Thomas (2019), Al-Gamal (2018), Keshavarz (2017) and Oluomachi (2016) whose studies reach the same results.

## 4.8 Summary

This chapter presents the results and analyses the data gathered by the two tests, interview and observation checklist. It also provides a comprehensive discussion for the Analysis and Results based on the research hypothesis mentioned in chapter one.

# CHAPTER FIVE

# Summary of the Study, Findings, Recommendations and Suggestions for Further Studies

## 5.0 Introduction

This chapter is devoted to present the findings of the analysis and discussion introduced in the previous chapter. It also provides a thorough summary for the whole study including the objectives of the study, instruments, sample and some remarks of the results. In addition to that, it highlights some recommendations for the stakeholders based on what the researcher concludes. Furthermore, it proposes some suggestions for further studies based on what the researcher believes to be missed or encounters some limitations. Finally, it provides alphabetically ordered list of bibliography and attaches of the whole appendices; instruments, validators qualification and raw data of the participants for test two 'word-list reading test'.

## 5.1 Summary

This study is meant to explore the cruciality of understanding and mastering English phonotactics of words involving ICCs and FCCs for Sudanese EFL undergraduates, their phonological errors in pronouncing English words involving ICCs and FCCs and the causes of these mispronunciations. It is also carried out to investigate the effectiveness of the methods, materials and activities used for teaching English phonotactics. In addition to that, it is meant to explore the reason of Sudanese EFL undergraduates' failure to correctly pronounce words containing CCs.

The researcher adopts a mixed approach to analyse the data. EFL university students (100 for the first test and 60 for the second) and instructor take part in the study. Using four instruments, two tests, interview and observation checklist, to collect the data from the real stakeholders of the current study, the findings reveal that Sudanese EFL undergraduates face a real challenge understanding and mastering the phonotactic system of English words involving ICCs and FCCs pronouncing them. It also reveals that unrequired pause, intrusive vowel insertion, deletion of consonant sound/s, replacement of consonant sound and consonant-vowel position conversion are the causes of these mispronunciations. Moreover, the methods, materials and activities used for teaching the phonotactic constraints to Sudanese EFL undergraduates are not effective and lack many principles of teaching pronunciation. Finally, these findings demonstrate that, as mentioned in the previous chapter and previous section, this failure is attributed to MT interference.

In short, Sudanese EFL undergraduates encounter tremendous problems in understanding and mastering English phonotactics of words involving ICCs and FCCs and pronouncing them.

## 5.2 Findings

1. Sudanese EFL undergraduates face magnitude difficulties in understanding and mastering English phonotactics of words involving ICCs and FCCs.
2. Sudanese EFL undergraduates mispronounce most English words involving ICCs and FCCs.
3. The major causes of Sudanese EFL undergraduates' mispronunciation are unrequired pause between consonant segments in one syllable, insertion of an

intrusive vowel to break the string of CCs particularly in ICCs more than FCCs and deletion of consonant segments in FCCs.

4. Other causes of the incorrect pronunciation are consonant replacement and consonant-vowel position conversion.

5. The most problematic groups of CCs for Sudanese EFL undergraduates are three ICCs and four FCCs.

6. Sudanese EFL undergraduates encounter significant difficulties in understanding and mastering the licit and illicit English words involving ICCs and FCCs.

7. Teaching methods, materials and activates used in teaching the sound system of English language to Sudanese EFL undergraduates are not effective for improving pronunciation skills and more particularly CCs of the students.

8. Sudanese EFL instructors rarely acquaint their students the differences between the phonotactic system of English and Arabic.

9. Personality, phonetic ability, motivation and attitude play extremely crucial roles in the process of understanding and mastering English pronunciation.

10. The participants' failure to correctly pronounce English words, apart from the causes, is attributed to the linguistics differences between the phonotactic system of their MT language and the TL.

## 5.3 Recommendations

For the sake of improving the students' pronunciation, understanding and mastering the phonotactic system of English and to overcome all shortcomings mentioned above and in the whole study, the researcher modestly derives the following recommendations to the stakeholders of this study (students, instructors, textbook writers, education policy makers and fellow researcher:

1. EFL students likewise instructors should be aware of the differences between their MT language and TL.
2. EFL instructors should explicitly acquaint their students the phonotactic differences between their students' MT language and TL especially those related to CCs.
3. EFL instructors should take proactive stance to prevent possible future pronunciation problems particularly with CCs.
4. EFL students should work hard on the phonotactics differences between their MT language and TL.
5. EFL instructors should expose their students to authentic audiovisual material so as to offer the right model which motivates students to have native-like accent.
6. EFL instructors should give their students more opportunity to practise pronouncing English words involving ICCs and FCCs.
7. When adapting and/or adopting course syllabus or textbook, instructors should integrate more oral activities for their lecture.
8. EFL instructors should not ignore the importance of activating pronunciation learning factors which are of great benefit not only for pronunciation but for the whole learning process.
9. Textbook writers should develop activities that promote oral skills.
10. Researcher should carry out more studies in the area of speaking and more particularly the area of pronunciation of CCs in order to draw the students attention which personally experienced by the researcher in this study.
11. Education policy maker should stand for the improvement of scientific research.

## 5.4 Suggestions for Further Studies

To have inclusive insights of the cruciality of understanding and mastering English phonotactics for Sudanese EFL undergraduates particularly in the area of CCs, the researcher suggests the following further studies to be carried out in the context of Sudan and/or any other context where English is taught as EFL:

1. To replicate this study using experimental approach.
2. To replicate this study on larger number of participants particularly with the class observation in the context of Sudan or any other EFL context.
3. To replicate this study using connected speech and/or natural conversation.
4. To investigate syllable-medial CCs in connected speech.

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# Appendices

# Appendix A

## Word-list Reading (Oral) Test

**Dear student** please read the following words **ONCE**, **clearly** and **loudly**.

# Part One:

**Section A:**

1. Fly
2. Blue
3. Pretty
4. Shriek

**Section B:**

5. Smile
6. Stay
7. Spin
8. Sphere

**Section C:**

9. Spread
10. Squeak
11. Stew
12. Splay

# Part Two:

## Section A:

    13.Stopped

    14.Strength

    15.Bulge

    16.Kept

## Section B:

    17.Asked

    18.Fifths

    19.Midst

    20.Exempt

## Section C:

    21.Glimpsed

    22.Thousandths

    23.Texts

    24.Sixths

# Appendix B

## Pseudo-word (Written) Test

F: [ ]  M: [ ]

Consulting your phonotactic knowledge, decide whether the following words are potentially possible (**P**) or impossible (**I**) English words in terms of consonant clusters.

**Notice: All these words are pseudo-words (are not actual English words).**

**Group A:**

| Pseudo-word | Potentially Possible | Impossible | Pseudo-word | Potentially Possible | Impossible |
|---|---|---|---|---|---|
| 1.  hreem | | | 2.  smood | | |
| 3.  nsaph | | | 4.  splack | | |
| 5.  lwam | | | 6.  lpsay | | |
| 7.  stram | | | 8.  vrog | | |
| 9.  jlow | | | 10.skreep | | |
| 11.proklem | | | 12.rskar | | |
| 13.dless | | | 14.bnack | | |
| 15.shyoom | | | 16.sreak | | |
| 17.rlism | | | 18.blick | | |
| 19.fwin | | | 20.tlment | | |
| 21.spliech | | | 22.rbel | | |
| 23.sbort | | | 24.svour | | |
| 25.sding | | | | | |

**Group B:**

| Pseudo-word | Potentially Possible | Impossible | Pseudo-word | Potentially Possible | Impossible |
|---|---|---|---|---|---|
| 1.  clasb | | | 2.  bimk | | |
| 3.  tricturesque | | | 4.  azk | | |
| 5.  kamp | | | 6.  lind | | |
| 7.  bourt | | | 8.  ranp | | |
| 9.  brainl | | | 10. quast | | |
| 11. manch | | | 12. ratf | | |
| 13. dethp | | | 14. eadze | | |
| 15. atk | | | 16. madst | | |
| 17. fext | | | 18. calsk | | |
| 19. exembt | | | 20. glimbsed | | |
| 21. antiplmns | | | 22. amainst | | |
| 23. tralfths | | | 24. fent | | |
| 25. vants | | | | | |

# Appendix C

## Interview

**Experience Questions (Introductory Questions):**

1. How long have you been teaching English at tertiary level?

2. How long have you been teaching phonetics and phonology or only phonology?

**Interview Questions:**

1.a What are the differences between the phonotactic system of English and Arabic?

1.b To what extent do you acquaint your students these differences?

1.c To what extent do you think being aware of these differences affect their mastery of the L2 pronunciation?

2. How often do you usually give your students opportunity to practise aspects of English sound system especially consonant clusters?

3. How often do you use authentic audiovisual materials in your class (for teaching CCs)?

4.a To what extent do you think Sudanese EFL undergraduates have pronunciation problems with ICCs and FCCs?

4.b What are the causes of the incorrect pronunciation of English words involving ICCs and FCCs?

4.c How do you remedy them?

5.a How do you think age is related to the mastery of pronunciation?

5.b What is the reflection of the students' age on their pronunciation?

5.c To what extent do you think personality, phonetic ability, motivation and attitude play a crucial role in the process of attaining native-like pronunciation?

6. Why do you think Sudanese EFL undergraduates fail to correctly pronounce words containing consonant clusters (ICCs or FCCs)?

# Appendix D

## Observation Checklist

| Checklist Item | Applied | Partially Applied | Not Applied |
|---|---|---|---|
| 1. The instructor uses authentic audible materials. | | | |
| 2. The instructor uses authentic visual materials. | | | |
| 3. The instructor provides tape recording to enable the students record their own voices. | | | |
| 4. The instructor provides the students with sound system, speakers or headphones to enable them listen to their own recordings. | | | |
| 5. The instructor takes proactive stance to prevent possible future pronunciation problems. | | | |
| 6. The instructor draws the attention of her/his students to the fact that NO Arabic word begins with two consonants. | | | |
| 7. The instructor explicitly acquaints her/his students with the differences between the phonotactic system of English and their native (Arabic) language. | | | |
| 8. The instructor gives the students opportunity to practise pronouncing what s/he teaches in the class. | | | |
| 9. The instructor frequently gives the students opportunity to practise pronouncing what s/he teaches in the class. | | | |
| | | | |

| Checklist Item | Applied | Partially Applied | Not Applied |
|---|---|---|---|
| 10. The students actively participate in the pronunciation activities in the class. | | | |
| 11. More than 80 % of the students practise pronouncing what they are taught during their lectures. | | | |
| 12. If there are any errors or mistakes, the instructor immediately remedies them. | | | |
| 13. The instructor corrects her/his students when they insert a vowel/s in two or three ICCs to avoid inserting in initial two and/or three CCs. | | | |
| 14. The instructor positively motivates her/his students to attain native-like pronunciation. | | | |
| 15. Students are highly willing to have a native-like accent. | | | |
| 16. The instructor employs technical terms during her/his lectures. | | | |

# Appendix E

## Validation Committee

| No. | Name | Qualification | |
|---|---|---|---|
| 1. | Dr. Abdalla Yasin Abdalla | Associate professor | Sudan University of Science & Technology |
| 2. | Dr. Ahmed Abdalla Mohmmed | Associate professor | Al-Neelain University |
| 3. | Dr. Hillary Marino Bitta | Assistant professor | Sudan University of Science & Technology |
| 4. | Dr. Mahmud Ahmed Ali | Associate professor | Sudan University of Science & Technology |
| 5. | Dr. Lwal John Lwal | Assistant professor | Nahda College |

# Appendix F1

## Word-list Reading Test 1 Data

### Participant #1

*TextGrid Part_1_F_SUST_21_Glimpsed* — Glimpsed /glɪmpəst/ instead of /glɪmpst/



*TextGrid Part_1_F_SUST_22_Thousandths* — Thousandths /θauzenθ/ instead of /θauzəndθs/
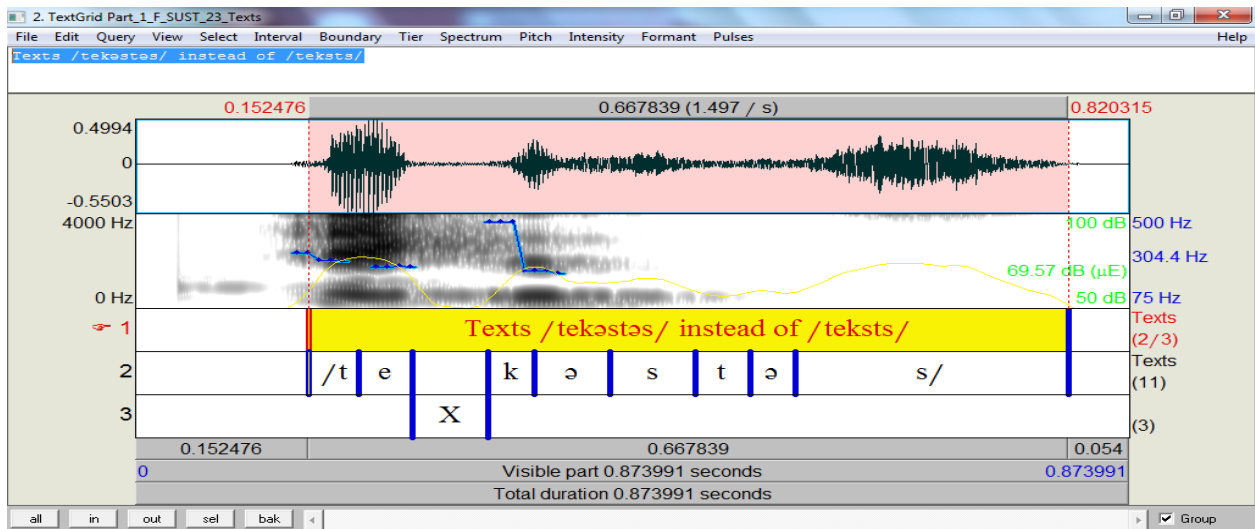


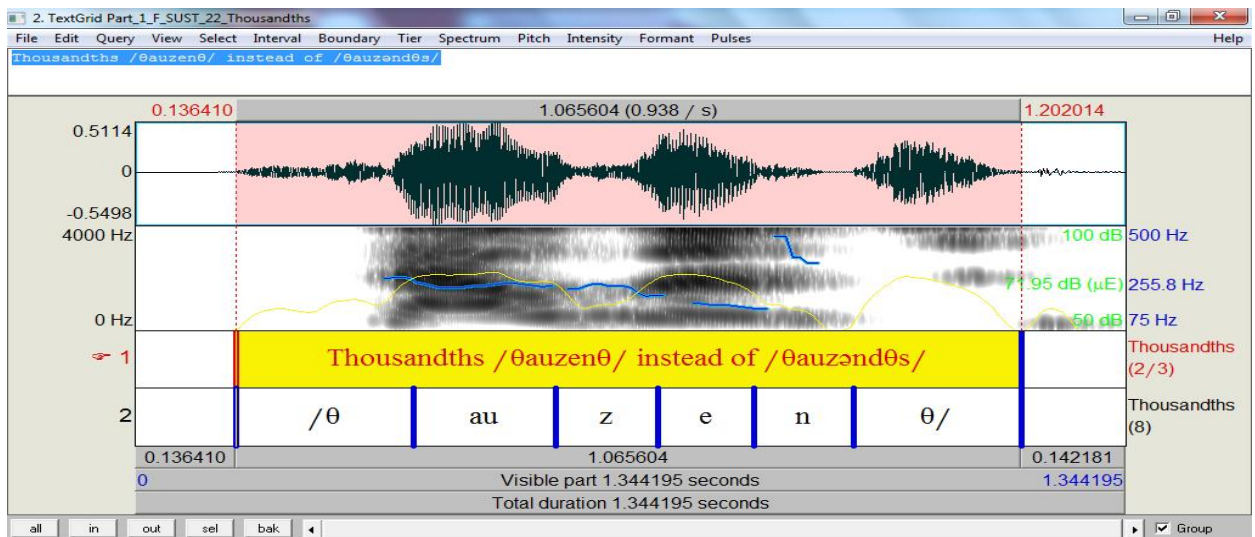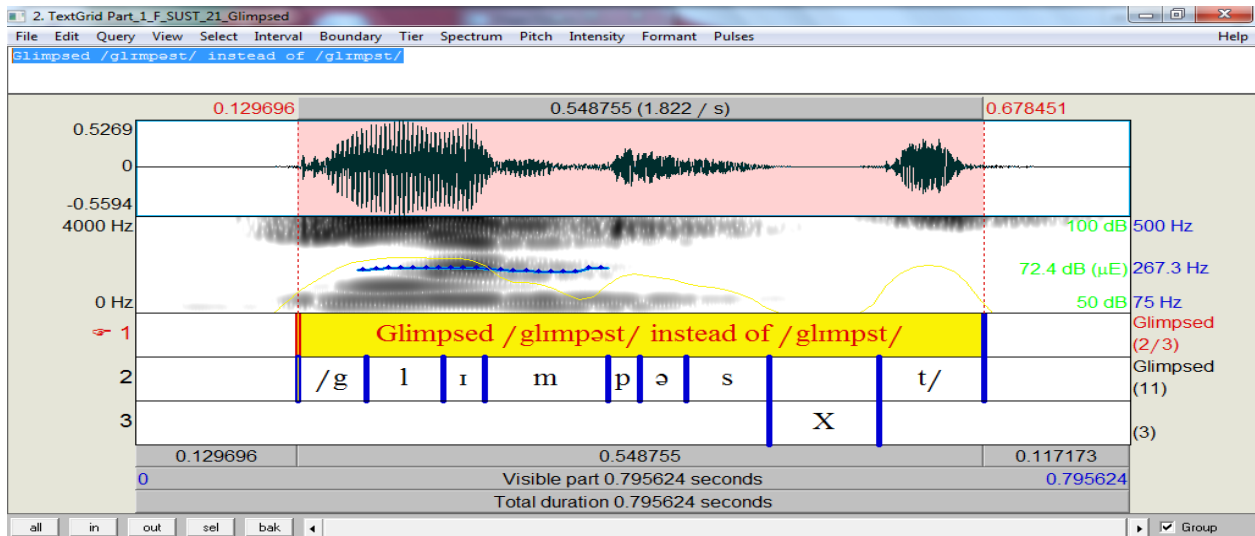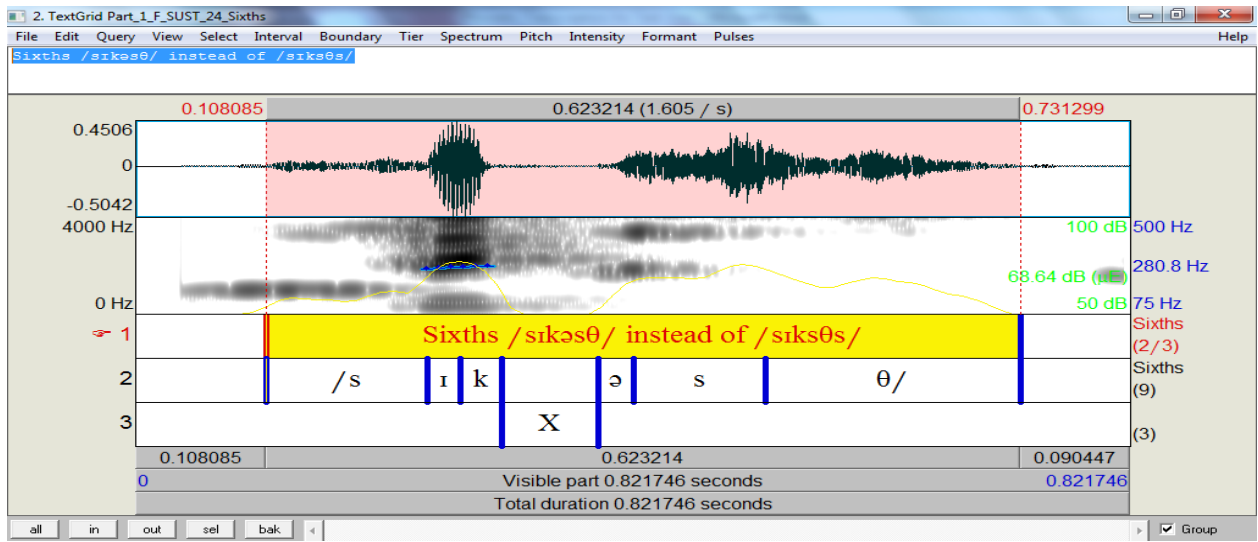*TextGrid Part_1_F_SUST_23_Texts* — Texts /tekəstəs/ instead of /teksts/
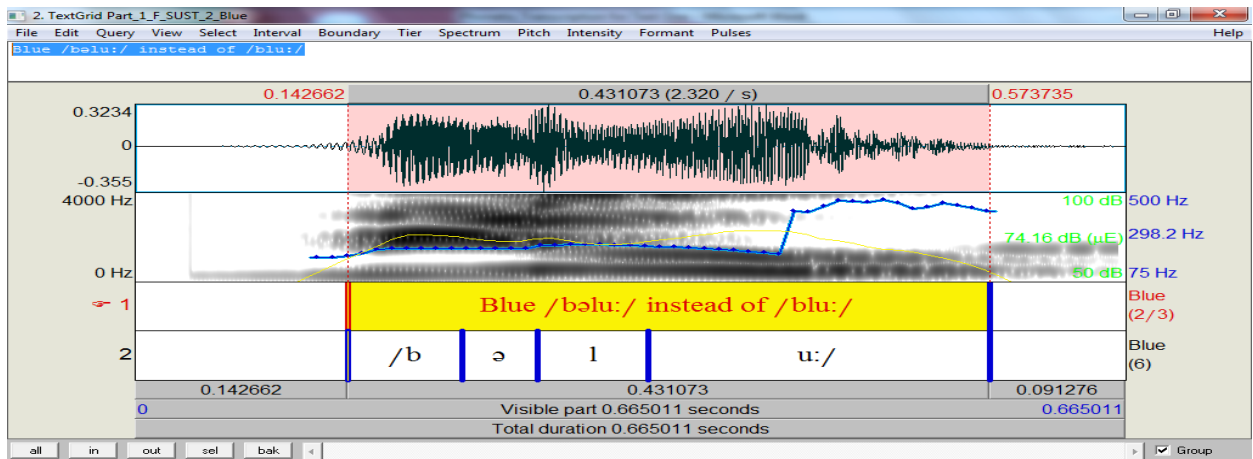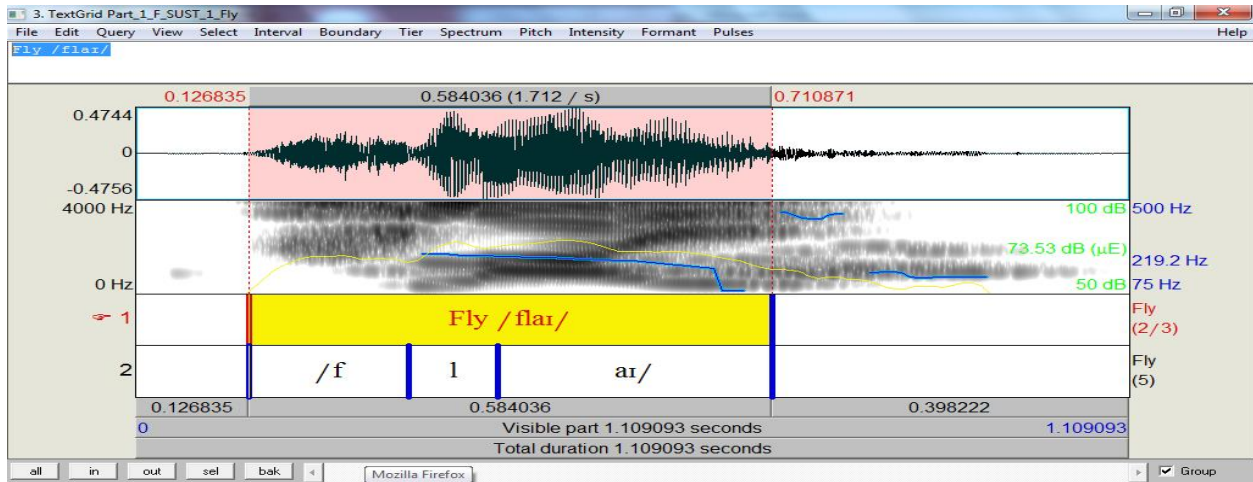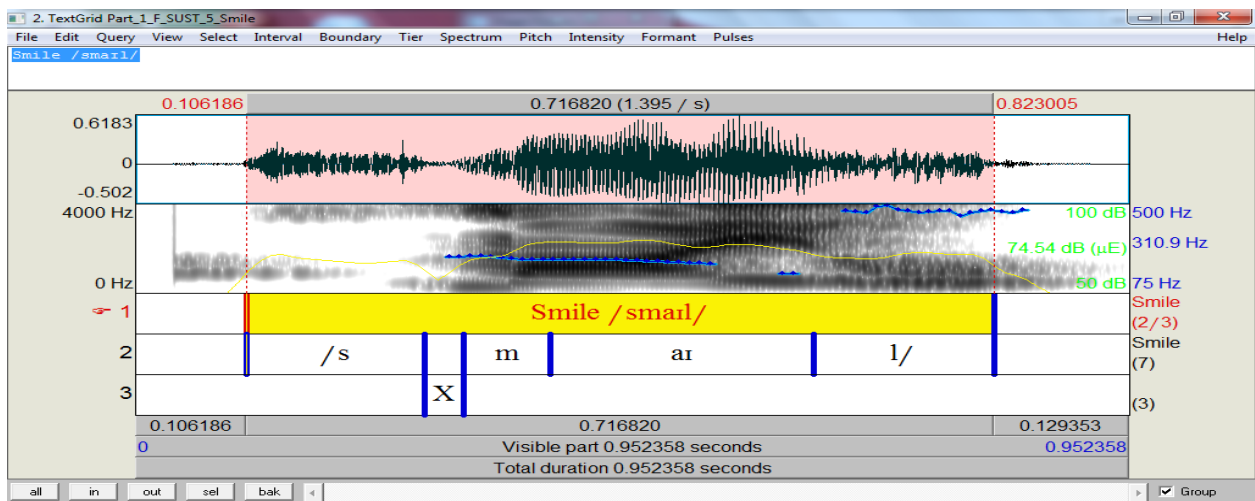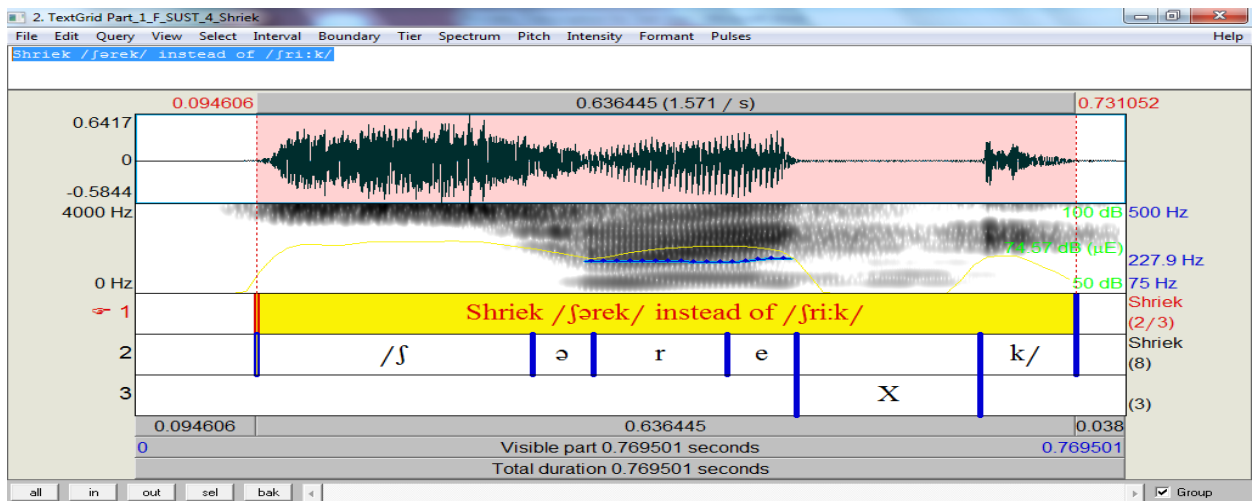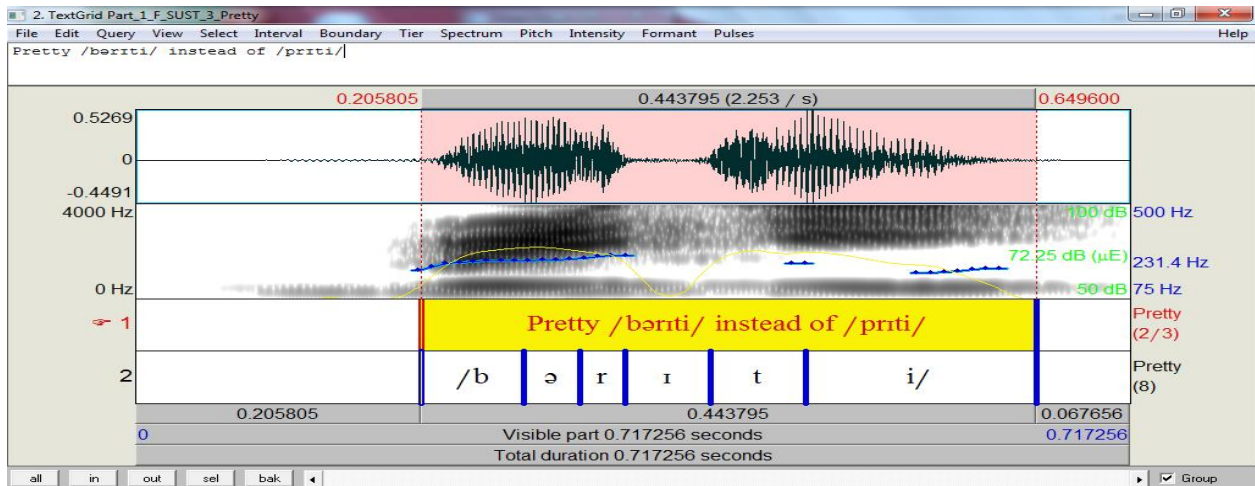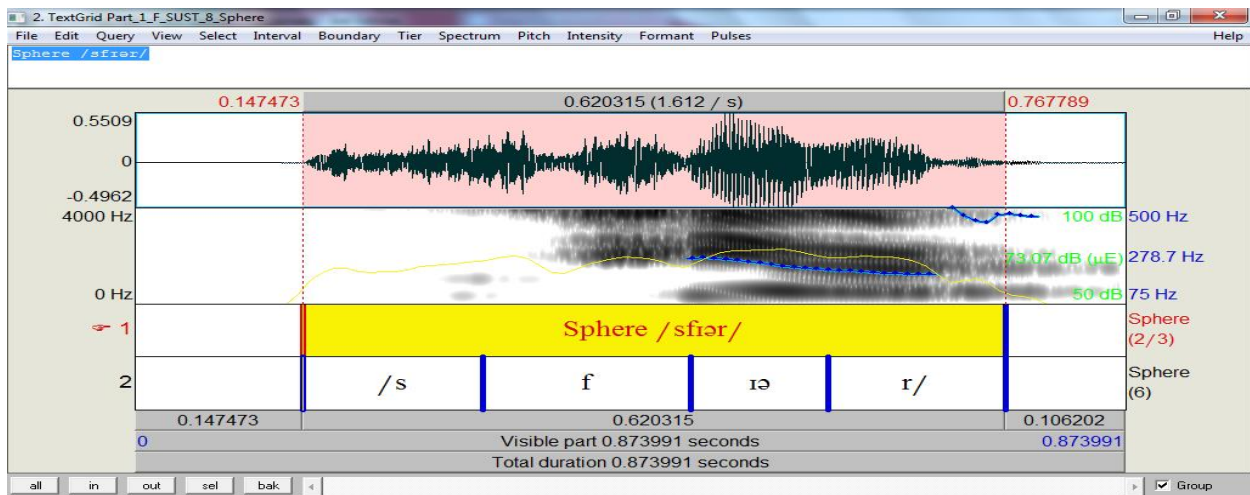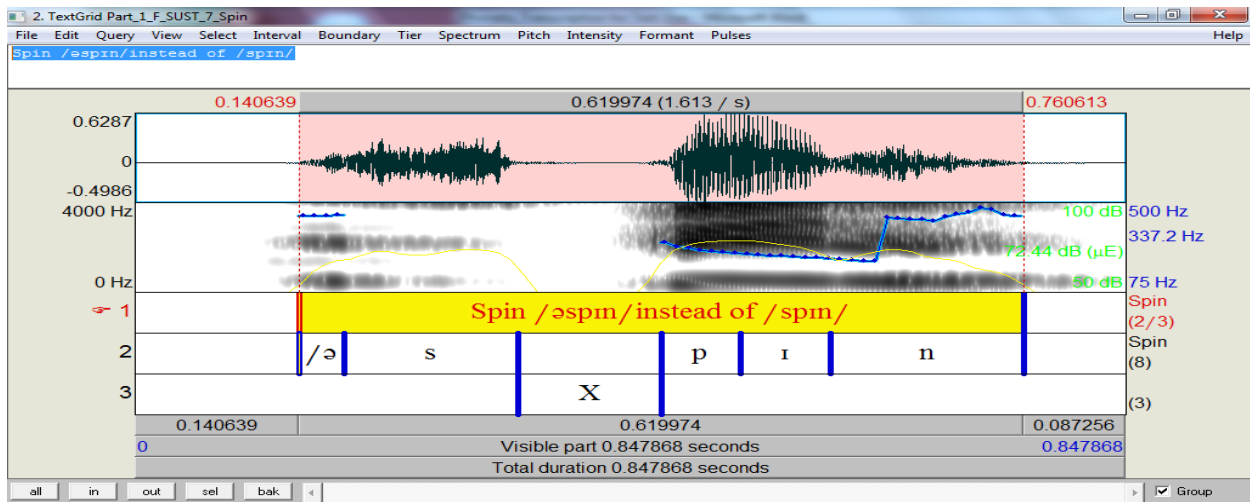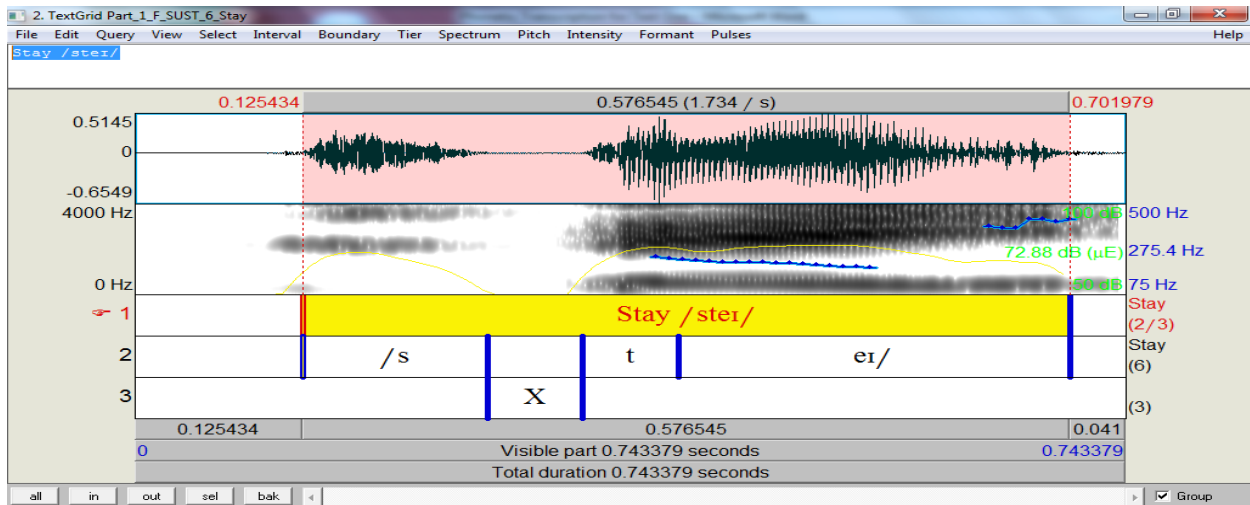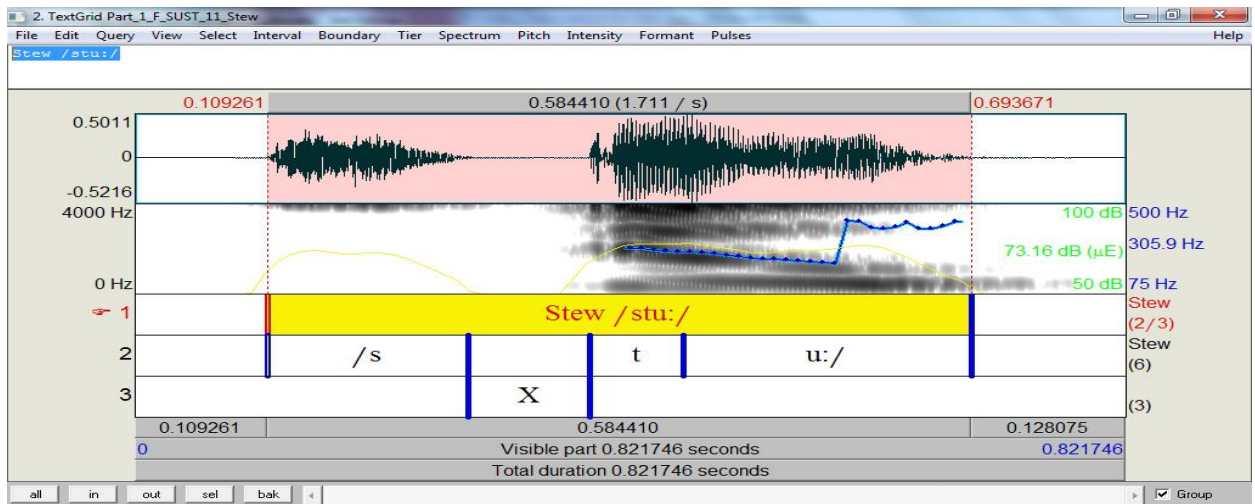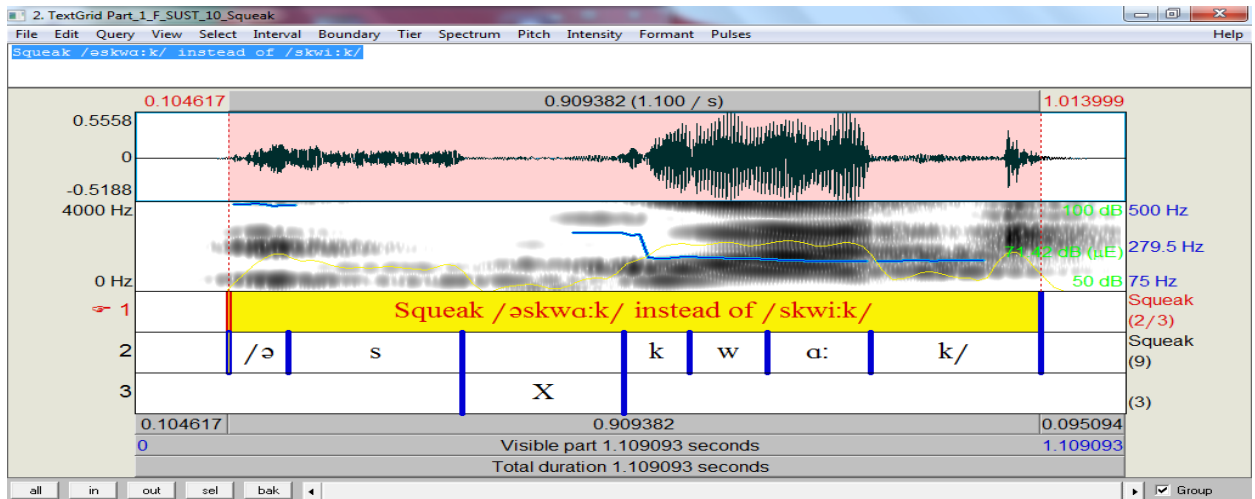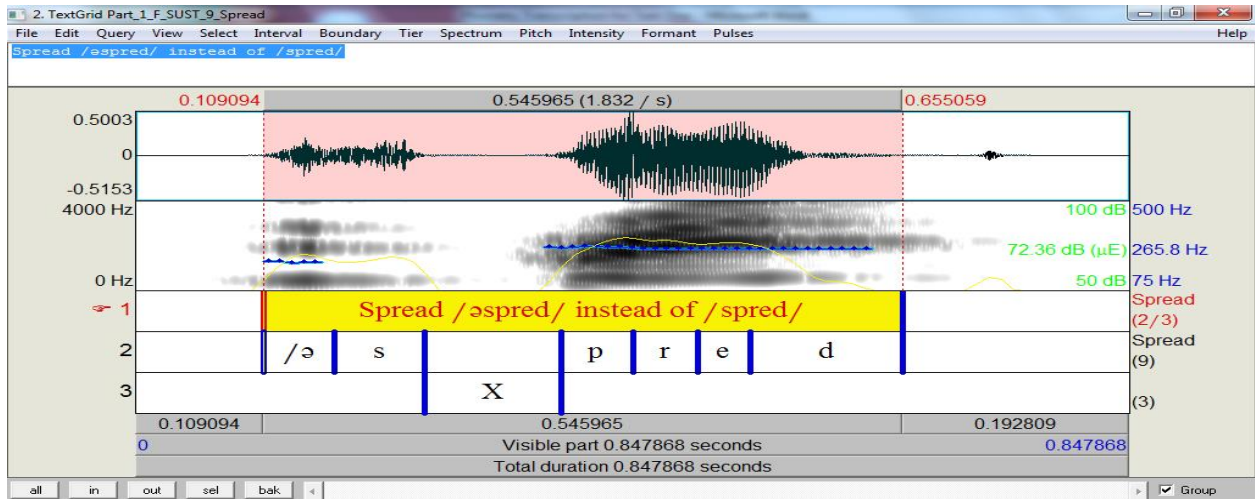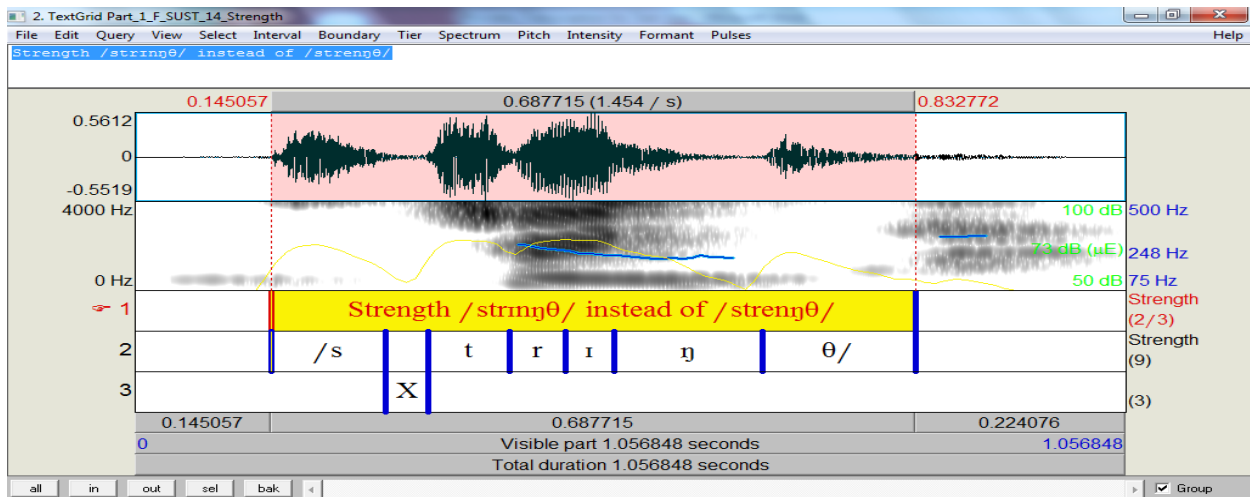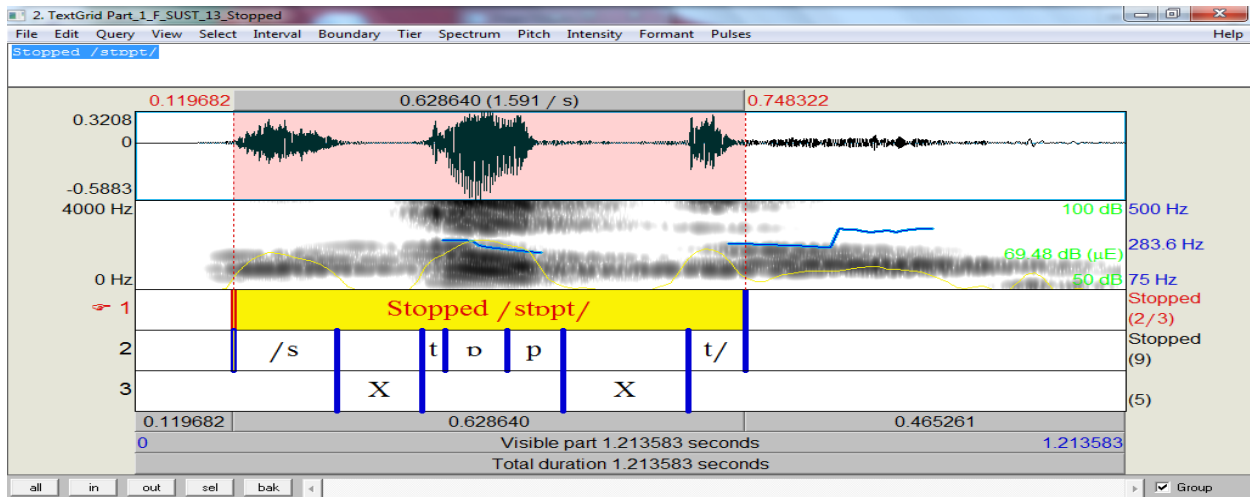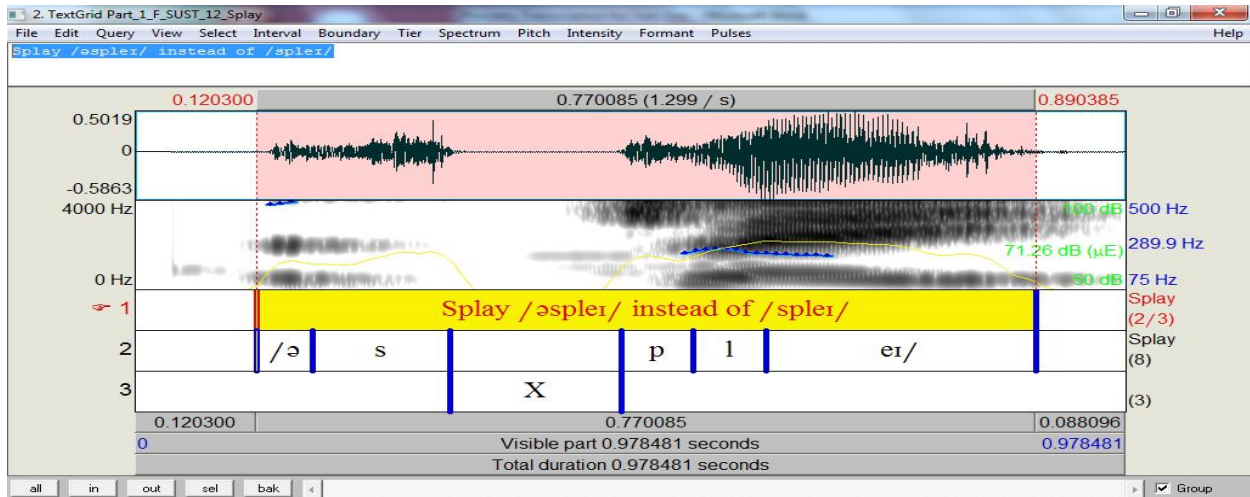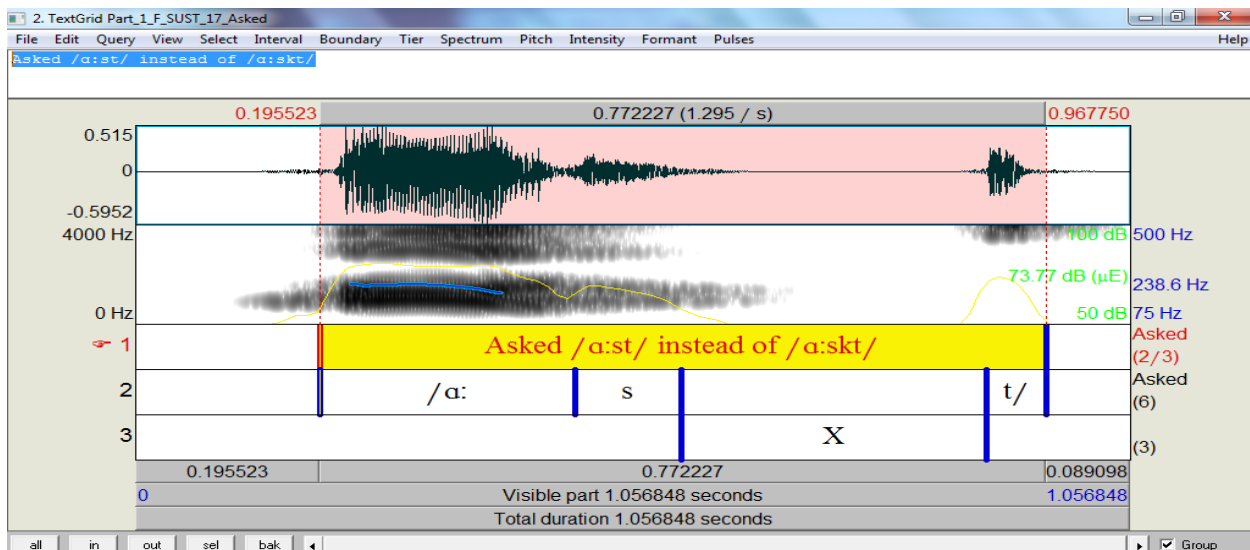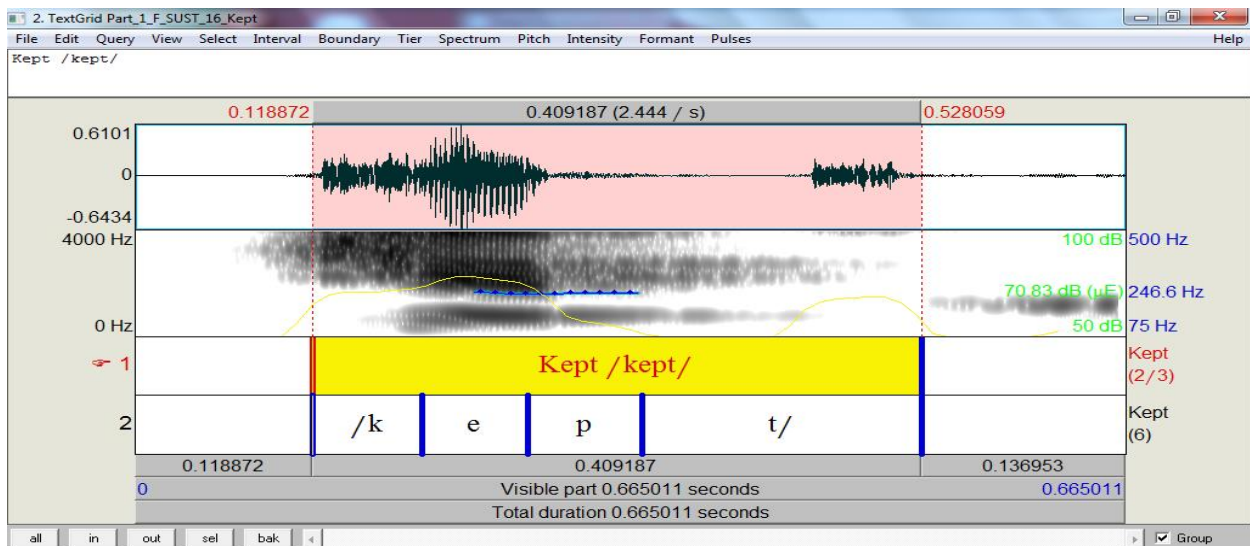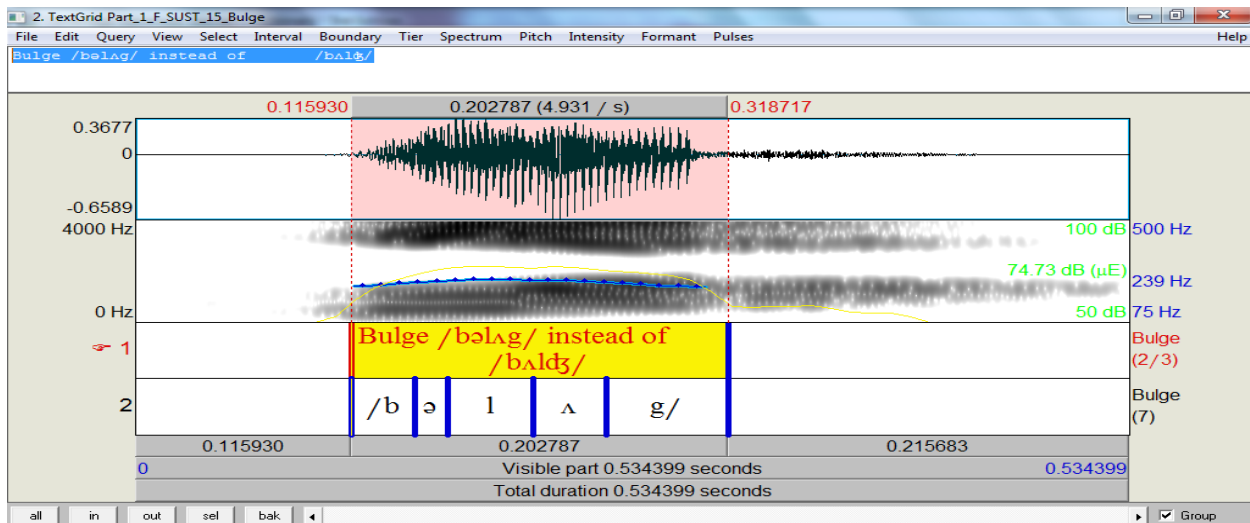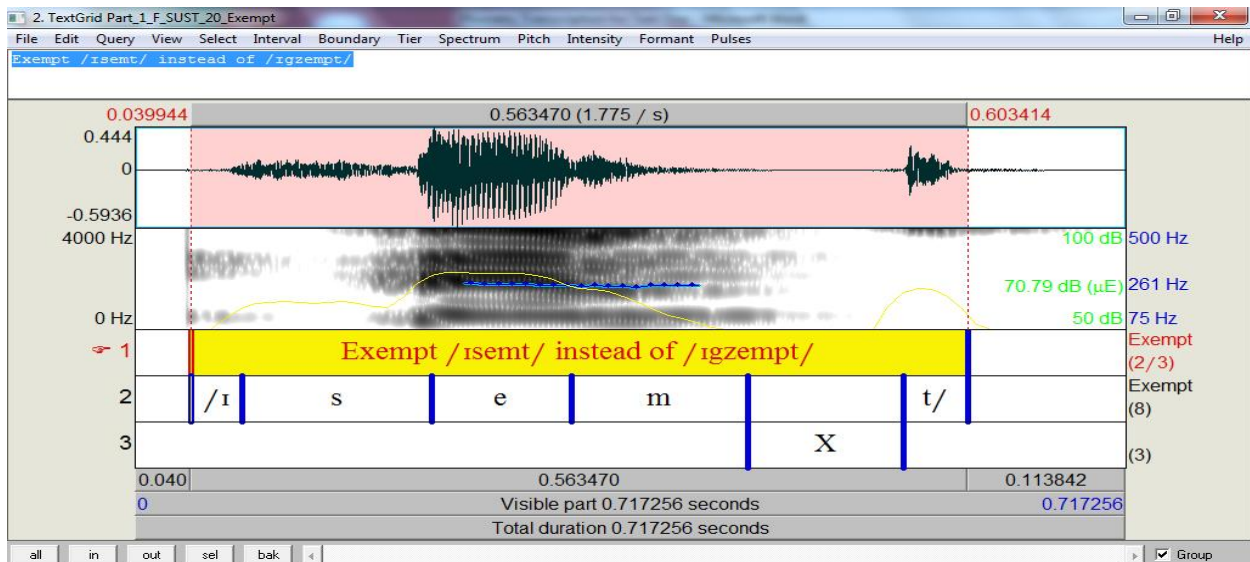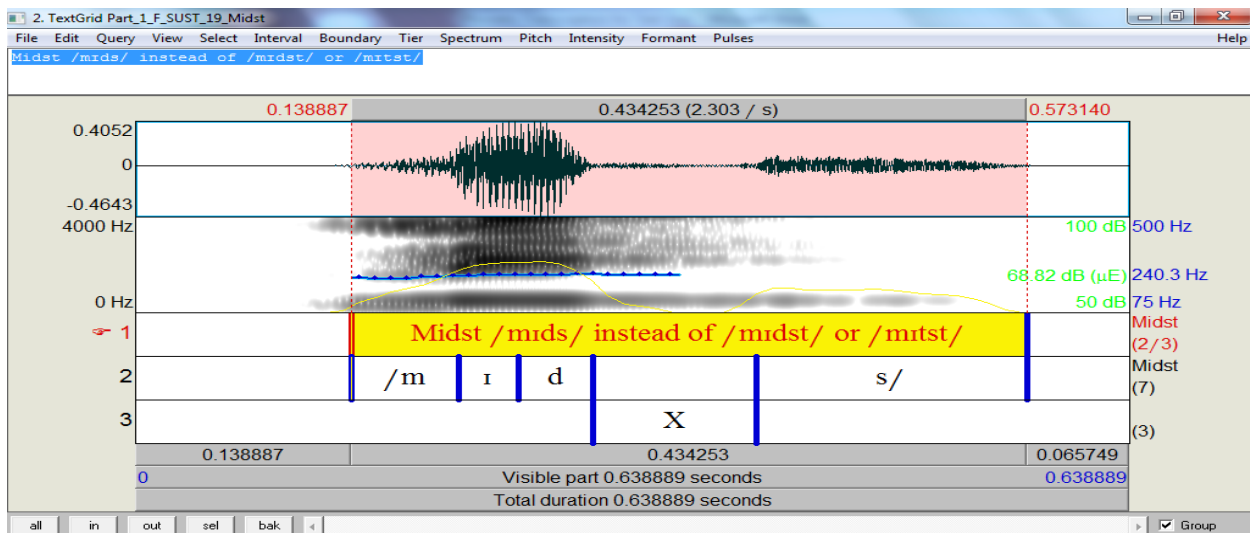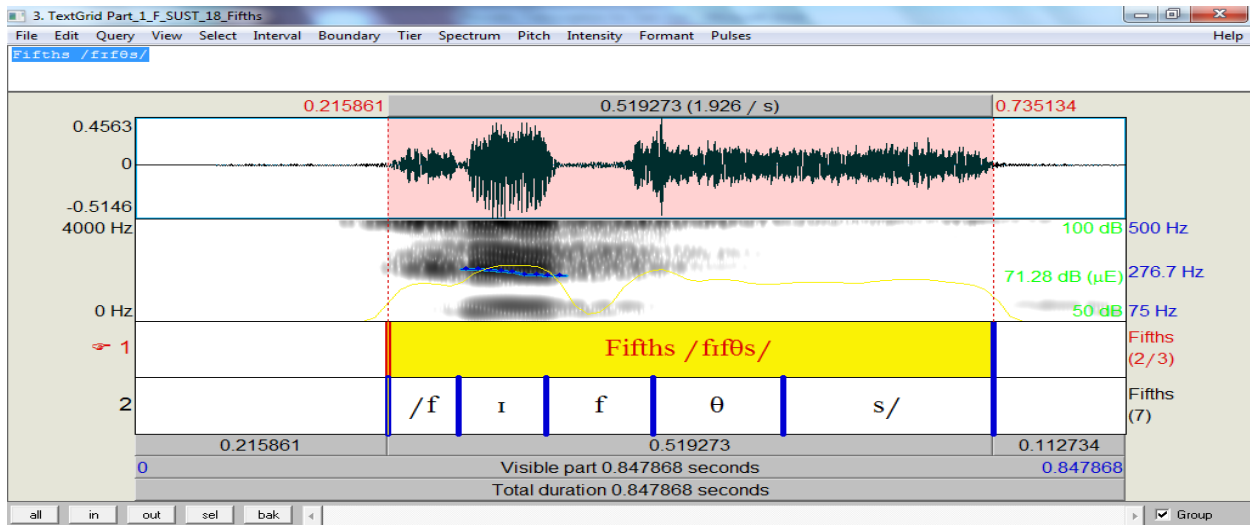
# Appendix F2

## The Whole Data for the Word-list Reading Test

The whole data of the word-list reading test can be download via the link below, scanning the bar-code or from the accompanied CD in the library. Hence, the data on the link or bar-code will be available till **August 2021**.



https://drive.google.com/drive/folders/18LfBUHBNzbGYvqb2IlWhn0RHDuBIrK
    4i?usp=sharing