Aural and Orthographic Input: Implications for the Acquisition of English Consonant Clusters by Northern Najdi Arabic Speakers

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I would like to dedicate this work to my family and University of Hail

Abstract

This study examines how exposure to orthographic input (OI) and purely aural input (AI) affects Arabic-speaking learners' initial acquisition of a syllable structure more complex than in their L1 since Arabic language does not have the consonant clusters that English has. It also investigates the relation between first language literacy and the acquisition of a new phonological system by exposing learners to different types of exposure: educational methods, i.e. AI only and AI + OI.

In this study, 60 participants aged between 25 and 38 (*mean = 31*) in the northern Najdi-speaking region of Saudi Arabia were given beginner lessons in English in three separate classes which revolved around 26 target words from a typical Saudi English curriculum. The teaching followed the methodology of Young-Scholten et al. (1999). The 26 words were divided into categories representing different types of English onset and coda clusters. Participants attended ten lessons over five weeks (two lessons per week; 20 minutes each session). None of them knew English or had any literacy in English and 20 also had no literacy in their native Arabic. The participants were divided into three groups: the non-literates (=20); an Arabic-literate aural-only group who were only exposed to aural input (=20), and an Arabic-literate word group which during learning was also exposed to orthographic input in English orthography (=20). The hypotheses followed previous research, that OI during learning and during testing would lead to more epenthesis and less deletion, with the added hypothesis that the Non-literate Picture Group would epenthesise the least and delete the most. Participants took a post-test where photos were displayed and participants were asked to say the word the photo represented. The literates took another post-test where the written forms of the words were displayed to see if seeing words written during testing made a difference.

The results indicated significant differences in the rates of epenthesis and deletion. In the aural test, the Non-literate Group had the highest rate of deletion compared with the Arabic-literate Picture Group. The AI group displayed a higher rate of deletion than the OI group, and the rate of deletion became significantly lower when this group was also exposed to OI during testing.

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The following abbreviations are used in the text.

/ /	input
[ ]	output
→	leads to
AI	aural input
C	consonant
C1	first consonant
C2	second consonant
CAH	Contrastive Analysis Hypothesis
L1	first language
L2	second language
LP	Literate Picture Group
LW1	Literate Word Group-test 1
LW2	Literate Word Group -test 2
MDH	Markedness Differential Hypothesis
MSA	Modern Standard Arabic
NA	Najdi Arabic dialect
NL	Non-literate Group
OI	orthographic input
SLA	second language acquisition
SSP	Sonority Sequencing Principle
IL	Interlanguage Phonology
TL	target language
V	vowel
ʔ̲	epenthetic glottal stop
μ	Mora
σ	syllable

Chapter 1. Introduction

Since the 1970s, inter-language epenthesis has been a topic of interest of many scholars (e.g. Eckman (1977), Tarone (1978), Broselow (1983, 1984), and Ioup and Weinberger (1987)). There is now a growing body of research on the role of orthographic input (OI) in promoting epenthesis (Young-Scholten et al. 1999; Rafat, 2011). Second language (L2) learners are frequently exposed, from the very start, to orthographic input (OI), written forms and their spelling in the target language (TL). L2 phonologists have indicated that epenthesis as well as other effects might result from exposing L2 learners to the orthographic form of the TL (Bassetti, 2009). Young-Scholten et al. (1999) and Rafat (2011) provide evidence showing that when L2 learners are exposed only to aural phonological input (AI), deletion is preferred to simplify consonant clusters not permitted in their first language (L1) and epenthesis is applied when learners are also exposed to the OI.

This study examines how exposure to orthographic input vs. purely aural input affects Arabic-speaking learners' initial acquisition of a syllable structure more complex than in their L1. It also investigates the relation between L1 literacy and the acquisition of a new phonological system by exposing learners to different types of exposure: aural phonological input only and phonological input along with orthographic input. Non-literate learners were truly non-literate, not knowing how to differentiate between any two Arabic alphabetical letters.

To achieve this aim, the following questions are addressed:

Q1) What role does L1 literacy play when acquiring a new, more complex syllable structure?

Q2) How does seeing words written in L2 during learning influence beginner Arabic-speaking learners' acquisition of English syllable structure? Is there an effect of OI during testing?

Before addressing the questions above, the significance of this study will be presented in section 1.1. Then, section 1.2 briefly gives information about the province in Saudi Arabia where the dialect selected for this research is spoken. Then, section 1.3 gives an overview of the structure of the thesis.

1.1 Motivation and Contribution

This study aims to contribute to our understanding of the influence of exposing L2 learners to the orthographic input of the target language, which is typical from the start in foreign language instruction to older learners, including in English as a foreign language. L2 phonologists such as Young-Scholten et al. (1999), Young-Scholten (2002), Bassetti (2007), Hayes-Harb et al. (2010), and Young-Scholten and Langer (2015) have researched the influence of written language input on the acquisition of L2 phonology, but the variable of literacy has never been explored in relation to orthographic input.

By investigating how exposure to orthographic input affects acquisition, this study will not only clarify the picture of how exposure to different phonological-orthographical input can affect Arabic-speaking learners' acquisition of English, it will also investigate the connection between literacy, OI and the phonology of L2.

This study will examine the relation between first language (L1) literacy and the acquisition of a new phonological system by exposing learners to different educational methods, i.e. AI and OI. Thus, it will investigate the influence of AI on L2 phonological acquisition among two types of learners: non-literate and literate. Indeed, although L2 researchers have found that L1 literacy is an important factor in L2 acquisition (e.g. Burt et al. (2003), and Faltis and Coulter (2008)), L2 phonologists (e.g. Bassetti (2007, 2009), Rafat (2011), Bassetti et al. (2015), and Young-Scholten and Langer (2015)) have only investigated the effects of OI on L1 literate learners and have not explored the relation between L1 literacy/illiteracy on the one hand and the exposure to written texts (OI) for new phonological systems on the other.

1.2 Where Najdi Arabic Dialect (NA) is spoken

Arabic is the native language of nearly four hundred million speakers living in 22 countries known as 'the Arab world' located in the Middle East and North Africa (UNESCO, 2014). In the ranking of the most spoken languages, according to UNESCO, Arabic comes fifth after Mandarin Chinese, English, Spanish and Hindi. It is the most widely spoken language of the Semitic languages, which include Arabic, Aramaic, Tigrinya, Hebrew, and Amharic. Classical Arabic (CA) is the older form of the language, dating back to the Caliphate era and used these days mainly when reading the Quran but not on a daily basis. Instead, 'Modern Standard Arabic' (MSA), which is derived from CA and includes modern terms and vocabulary, is now the official language at school, in the media, in books and broadcasts in many Arabic countries, including the Kingdom of Saudi Arabia..

The term 'Arabic language' does not refer to a single dialect, rather, it is a group of different spoken dialects (Ingham, 1994). MSA is the official and literary variety while spoken varieties or dialects are numerous in the Arab world (Javed, 2013). Prochazka (1988) divides the Saudi Arabian dialects into two main sub-divisions; the first division includes dialects that are spoken in Southern Hijaz and the Tihama, while the second includes the Najdi dialect as well as the Eastern Arabian dialects. Ingham (1994) adds that Prochazka's division could be extended northwards to include the rest of Hijaz, as it could be extended eastwards to include Dhufar and Greater Yemen. Ingham (1994) concurs with Prochazka (1988) that one of these varieties is Najdi Arabic (NA), which is spoken by people who live in Najd Province, the middle region of the Arabian Peninsula which today includes the Kingdom of Saudi Arabia. Following Al-Sweel (1987) and Ingham (1994), Alqahtani (2014) mentions that Najd is a term used to refer to the area located between the borders of Jordan in the north and the borders of Yemen in the south, and from the mountains of Hijaz in the west and the Ahsa oasis in the east.

In spite of determining the geographical areas where NA is spoken, Ingham (1994) mentions that the term 'NA dialect' does not refer to only one dialect, but rather it refers to a relatively similar cultural group of dialects that can be termed as NA dialects. These dialects are spoken by (1) the residents of central Najd including the districts of al-Ārid, Sudair and Al-Washm, Jabal Shammar and Qassim in the north to Bisha and Najran in the south.[1] Moreover, Ingham (1994) observes that these dialects also include (2) the speech of the Bedouin tribes who live in

[1] Jabal Shammer is a mountain near Hail city where this study was carried out.

areas such as Awazim, Mutair, Dawasir, Bugum, Harb, Utaibah, Anizah, Rashayidah, Suhul, and Subai. The speech of Ajmān and Ghatan and Āl Murrah in the east and south of the Arabian Peninsula as well as the speech of the Dhafīr and Shamar tribes from the north of the Arabian Peninsula are considered Najdi dialects. According to Ingham (1994), Najdi dialects also include (3) the speech of émigré Bedouin tribes who live in the Jazirah of Iraq and those who live in the Syrian Desert (of Shammar and Anizah extraction). Figure 1-1 below shows the borders of Najd Province in Saudi Arabia. These three main Najdi dialect groupings, according to Ingham (1994), differ in morphology but the phonology as well as the syntax are relatively unchanging.

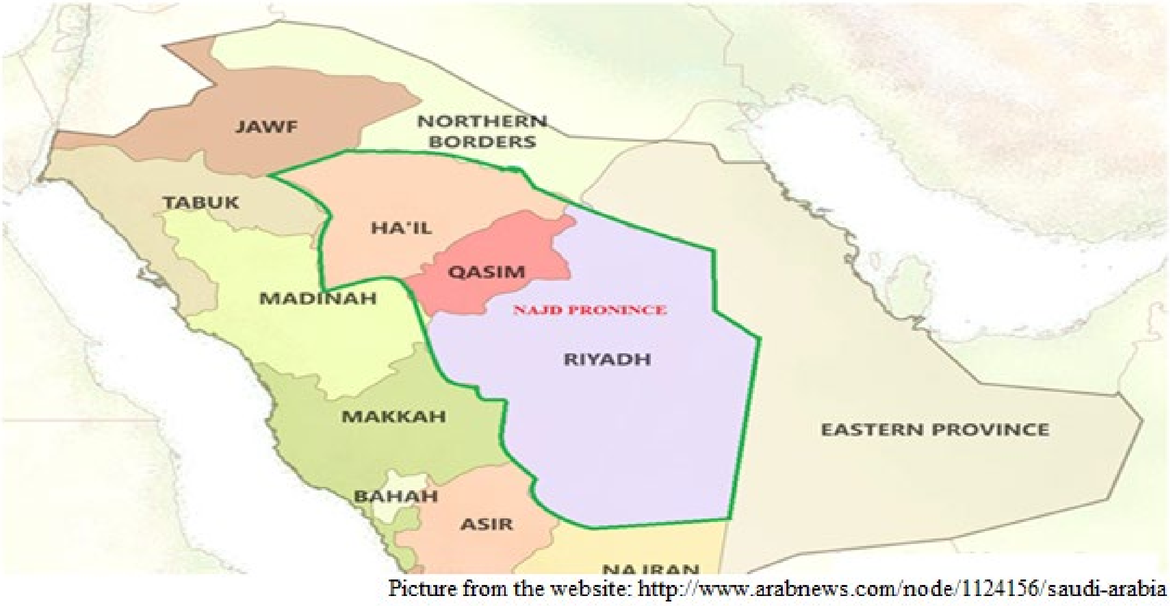

Figure 1-1: Najd Province

NA was chosen by the author for reasons of convenience; it is the author's native dialect and it does not have some C clusters found in English. In addition to this, the area where NA is spoken, Najdi Province, has a reasonable number of non-literates who the researcher could easily contact. The focus of the research was on Najdi Arabic-speaking learners' acquisition of new phonological forms.

The next section gives an overview of how the thesis is organised.

1.3 Overview of the thesis

This thesis is composed of six chapters, starting with Chapter One, the introduction chapter. In this chapter, the author explains the importance of the current study and indicates where the participants' dialect is spoken. Chapter Two presents the theoretical background and clarifies orthographical and phonological features of Najdi Arabic, comparing it to the target language of this study (English). It starts by reviewing the phonology, including consonant and vowel inventories of both languages, and then discusses some issues relating to the writing systems of English and Arabic. The chapter also discusses the syllable structure of NA and English and then presents influences that are known to trigger epenthesis, such as preference for a CV syllable and the Sonority Sequencing Principle.

Chapter Three addresses the phenomenon of interest, i.e. orthographic input, and other theoretical accounts in SLA. After that, the chapter reviews some findings from studies on exposure to OI during L2 learning and, thus, reviews previous research on exposure to only aural input and exposure to orthographic input along with aural input. By identifying L1 literacy level as a variable in L2 acquisition, this chapter then discusses the effects of first language literacy on L2 acquisition and also looks at the phonological error patterns that have been observed for children without literacy during L1 acquisition.

Chapter Four presents the hypotheses and methodology of the current study. The participants in this research and their level of education are comprehensively presented. Materials of the study as well as methods of teaching the lessons that participants took will also be presented in the chapter. The chapter also describes how the study data was analysed.

Chapter Five presents the results of the experimental study introduced in the fourth chapter, where comparisons among the three groups that answer the questions of this research will be presented. Thus, Chapter Five is sub-divided into many sub-sections to make comparisons clearer.

Chapter Six, in light of the previous studies reviewed in Chapters 2 and 3, discusses the findings presented in Chapter Five.

Chapter Seven concludes the thesis. The chapter also presents limitations and makes suggestions for future research.

Chapter 2. Literature Review: Najdi Arabic Phonology and Orthography in Comparison with English

This chapter discusses the phonology and orthography of Najdi Arabic (NA), Modern Standard Arabic (MSA), and English. It starts by looking at the segmental inventories, since target words have some consonants that do not exist in NA or MSA. Hence, this chapter is sub-divided into two main sections. The first section is devoted to introducing the phonological and orthographic features of NA dialect compared with English language and in some cases with Modern Standard Arabic. NA, MSA and English have to be covered since they are either (1) known to the participants (NA is the native language for all participants, but 20 are non-literates), (2) known to some of the participants (MSA is an additional variety for the 40 literate participants), or (3) the target language (English). The relevant literature relating to the phonology and orthography of NA dialect will be presented in 2.1. This section will in turn be sub-divided into introducing consonants of NA and English in 2.1.1 followed by a comparison of the two consonant inventories in 2.1.2 where the previous studies on some consonants will be covered, such as /p/ because this consonant is found in many target words of this study such as /pleɪn/ ‘plane’, /plʌm/ ‘plum’, and /spreɪ/ ‘spray’ (details of the target words will follow in Chapter 4, section 4.5.1). Then, section 2.1.3 will briefly introduce the two vowel inventories, and a comparison between English and NA vowel inventories will be given where necessary.

The second main sub-section starts from 2.2 where the syllable structure of NA will be comprehensively presented and compared to the syllable structure of the English language. This section will also introduce factors motivating epenthesis, such as sonority hierarchy and CV as a universal syllable. Then, the reader will be given a brief comparison of the writing systems of NA and English in 2.3.7. Section 2.4 summarises the chapter.

2.1 English and NA Phonology Contrasted

English and Arabic have many differences, which makes learning English language not that easy for Arabic speakers, nor learning Arabic easy for English speakers (Javed, 2013). In fact, the effects of a learner’s L1 on the acquisition of subsequently learned languages has been the interest of L2 phonologists since the work in this area was first started in the 1950s (e.g. Weinreich (1953) and Lado (1957)). According to Graddol (1997), English is not exclusive to its native speakers anymore, and it continues to spread worldwide as a second language in many cultures. It was stated earlier that NA belongs to the Semitic language family. By contrast, English belongs to a separate language family, since it is one of the Indo European (Germanic) languages (Fulk, 2008).

The following sub-section introduces the NA dialect and the English consonant inventories and then section 2.1.2 compares them.

2.1.1 *Phonetic Inventory Systems of NA and English*

As an overview, the entire inventory of consonants in NA as well as English is given in Table 2-1 and Table 2-2 below and represented by place and manner of articulation. Later, the author will discuss consonants that exist in English language but do not exist in NA, such as /p/, /v/ and /tʃ/ in section 2.1.2. (Table 2-1 is adapted from Al-Sweel (1981) and Ingham (1994)).[2]

[2] Although NA shares most of its consonant inventory with that of Classical Arabic and Modern Standard Arabic, there are some phonemes that do not exist in NA, such as:

- The voiced alveolar emphatic stop /dˁ/ is realised as a voiced interdental fricative /ðˁ/ (Abboud, 1979; Feghali, 2004).
- Ingham (1994) observes that the voiceless unaspirated uvular /q/ is substituted into a voiced velar plosive /g/.
- Ingham (1994) notes that the medial glottal stop exists only in words borrowed from CA as in /qur.ʔaan/ ‘Qur’an' and /roʔya/ ‘vision’. Instead, NA speakers use a long vowel to replace the medial glottal stop in words such as /ðiʔb/→ [ði:b] ‘wolf’ and /raʔs/ → [ra:s] ‘head’.

Table 2-1: NA Consonant Inventory

Manner of Articulation	Place of Articulation										
	Bilabial	Labio-dental	Dentals	Emphatic interdental	Alveolar	Emphatic alveolar	Alveo-palatal	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosives	b				t d	tˤ			k g	q		ʔ
Fricative		f	θ ð	ðˤ	s z	sˤ	ʃ			χ ʁ	ħ ʕ	h
Affricate			ts dz				ʤ					
Nasals	m				n							
Lateral					l							
Flap					r							
Glides	w							j				

Table 2-2: English Consonant Inventory

Manner of Articulation	Place of Articulation											
	Bilabial	Labio-dental	Dentals	Emphatic interdental	Alveolar	Emphatic alveolar	Alveo-palatal	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosives	p b				t d				k g			ʔ
Fricatives		f v	θ ð		s z		ʃ ʒ					h
Affricates							tʃ ʤ					
Nasals	m				n				ŋ			
Lateral					l							
Flap					ɹ							
Glides	w							j				

From the tables above, we can see that many consonants are shared in both languages, such as /b/, /t/, /d/, /k/, /g/, /ʃ/, /Ɵ/, /ð/, /ʒ/, /s/, /z/, /f/, /m/, /n/, /w/, /j/, /h/, /l/, / ʤ/. Some are found only in NA, such as / tˤ /, /q/, /ʔ/ /ðˤ/, /sˤ/, /ħ/, /χ/ /ʁ/, /ts/, /dz/, /r/, and others are unique to English, such as /p/ /v/, /ŋ/ and /tʃ/. Consonants that are unique to the NA dialect will not be discussed, since participants learned English and not vice versa. Types of sound transfer were described by Weinreich (1953). These types included (1) sound substitution in which an L2 learner substitutes non-existing sound to the nearest L1 equivalent as in the case of L1 English [ɹ] which is substituted with L2 Spanish [r] (English speaker learning Spanish). Also, (2) phonological processes in which an L2 learner relies on an L1 allophonic variant that is not available in a similar environment in the L2. For example, French speakers use [l] in coda position instead of velarized [ɫ] in L2 English. In (3) underdifferentiation two sounds are allophones of the same phoneme in L1 but they are different phonemes in the L2, as with [d] and [ð] when produced by Spanish speakers learning English. Whereas with (4) overdifferentiation two sounds are allophones of the same phoneme in the L2 but different phonemes in the L1 (the opposite case of the previous type). With (5) reinterpretation there are distinctions in which a learner reinterprets secondary features as distinctive or primary features, as in the case of interpreting an English lax/tense feature as long and short features by German L1 speakers. Lastly, (6) phonotactic interference where L2 learners modify an L2 syllable structure to conform to their L1 syllable structure (this will be discussed in the next chapter).

In the following sub-section, the author will compare the two consonant inventories while focusing on consonants that do not exist in NA. Furthermore, the author will refer to research on interlanguage phonology where the source of errors is not the learner's L1.

2.1.2 *English and NA Consonants Contrasted*

Since the two languages, English and NA, differ in terms of their phonemic systems, as seen in Table 2-1 and Table 2-2, Najdi Arabic-speakers learning English are predicted to face difficulties when acquiring non-existing sounds in their native consonant inventory. According to Flege (1981), the speaker's native language influences their pronunciation of sounds of the TL. This includes phonotactic rules as well as distinctive features. Lado (1957) and Flege (1981) find that cross-language influence can be organised on three main levels. Firstly, (1) phonemic, segmental phonetic and the phonetic implementation of a feature. The phonemic level is when a sound in a foreign language is mispronounced because no analogous sound exists in the phonemic inventory of the learner's native language. In addition to this, (2) interference may occur at the segmental level. Also, (3) influence might result from cross-language differences in the phonetic implementation (allophonic process). Eckman (1981) and Tarone (1981) were the first to note that not all errors are based on the learner's L1. Tarone (1981) mentions that a communication strategy is "the mutual attempt by two interlocutors to agree on a meaning in situations where the requisite meaning structures do not seem to be shared" (p.245). Eckman (1981) asks to what extent are interlanguages (ILS) independent of the native language (NL) and the target language (TL). In his study, Eckman recruited four English learners: two native speakers of Mandarin and two native speakers of Spanish. Findings revealed that learners made errors while not being motivated by the NL or the TL.

By looking at the two consonant inventories of the two languages (NA in Table 2-1 and English in Table 2-2), sounds such as /p/, /v/, /tʃ/ and /dʒ/ among others exist in English but do not exist in NA. Flege (1980) notes that L2 learners rely on their knowledge of L1 and substitute non-existing sounds of L2 to the closest counter part of L1. Similarly, Hock and Joseph (1996) mention that the principle of minimal modification functions by replacing foreign sounds with their closest counterpart which is available in the native inventory.

With regard to the voiceless bilabial plosive /p/, NA dialect has the voiced bilabial plosive /b/ but lacks its counterpart /p/ in its consonant inventory. However, NA speakers devoice voiced obstruents (/g/, /d/ and /b/) in the final position. According to Minimal Consonantismus and Minimal Vocalismus:

> At the beginning of the first stage of language development for children, the acquisition of vowels is launched with a wide vowel, and, at the same time, the acquisition of consonants by a forward articulated stop. An a emerges as the first vowel, and generally a labial as the first consonant, in child language. The first consonantal opposition is that of nasal and oral stop (e.g., mama-papa), which is followed by the opposition of labials and dentals (e.g., papa-tata and mama-nana). These two oppositions form the minimal consonantal system of the languages of the world. These are the only oppositions that cannot be lacking anywhere, provided that there is no mechanical deformity of the speech apparatus (dyslalia labialis). (Jakobson, 1968, pp. 47-48)

Accordingly, Prince and Smolensky (1993) mention that if a language's consonant system has the most marked of the hierarchy /b/, the least marked of its counterpart /p/ will also be a part of the set. This means that if /b/ exists in a language, /p/ also exists but not the opposite.

Similar to the NA dialect, in other Arabic varieties Watson (2002) notes that voiced plosives (/g/, /d/ and /b/) are devoiced to be (/k/, /t/ and /p/), respectively, in two Arabic dialects, namely Cairene and San'ani. According to Watson (2002), devoicing occurs in two positions. The first is when these voiced consonants are to the left of a voiceless consonant in such examples as /wa**g**t/ → [wa**k**t] 'time', /raga**d**t/ → [ra.ga**t**t] 'I slep' and /kata**b**t/ → [ka.ta**p**t] 'I wrote'. The second position of devoicing an abstruent occurs when it becomes a word or clitic-final position, as in /ba:**b**.kabi:r/ → [ba:**p**.kabi:r] 'a big door'. Following on from Watson's position (2002), NA speakers do devoice voiced obstruents in the same positions as Watson (2002) observes in such examples as /sˤi**d**t/ → [sˤi**t**t] 'I hunted something' and /gi**d**t/ → [gi**t**t] 'I drove'.

Moving to another position where /p/ could be acquired, in an experimental study in the perception and production of /p/ by Gulf speakers, Buali (2010) limited the focus of his study to the production of /p/ in monosyllabic words in the onset position adjacent to a limited set of vowels. Generally, the findings support the assumption of Flege (1980), that L2 learners depend on their knowledge of L1 and substitute non-existing sounds of L2 to the closest counter part of L1. According to Buali, /p/ was realised word-initially as [b] by most of the participants. He also mentions that since /p/ behaves differently depending on its position in the word, further research is recommended to investigate the production of /p/ in other positions, such as word-medially and word-finally (coda), as well as being a member of a consonant cluster (onset or coda).

In another Arabic variety, Salem (2014), similar to Watson (2002), observed that Levant Arabic speakers' production of the phoneme /p/ is associated with the phonetic environment where it exists.[3] According to him, in a few Arabic words, /p/ is realised as an allophone of /b/ if it occurs before a voiceless consonant.

Another consonant absent from NA and present in English is /tʃ/. Although MSA's and NA's consonant inventories lack the segment present in English, a /tʃ/, NA speakers of English seem to have no difficulty producing this phoneme particularly word-initially because NA allows biconsonantal clusters word-initial (Alqarni, 2013). However, it is substituted with its less-marked counterpart /ʃ/ word-finally. MSA speakers should have difficulty in the production of /tʃ/ in the onset position since MSA does not permit two-consonant clusters word-initially (Abushihab, 2010). Recalling what was introduced earlier in Chapter 1, section 1.2, MSA is not spoken in daily life but it is used as the official language in school, media, and books. That is, there are no native speakers of MSA, rather the home variety spoken is NA.

In a study of NA dialect speakers' pronunciation of /tʃ/ in English, Alqarni (2013) summarises results that show that /tʃ/ is more difficult to produce in the coda for Najdi Arabic learners than in onset. According to Alqarni, NA speakers produce words containing /tʃ/ in onset with no significant rates of errors in words such as 'chapter' /tʃæptər/ → [tʃæptər]. Errors of production become greater when NA speakers face words containing /tʃ/ in the coda, in words like /ti:tʃ/ → [ti:ʃ] 'teach'. The possibility of producing this phoneme as onset is probably due to the fact that even if Najdi Arabic does not have the /tʃ/ as a phoneme, it allows two-consonant clusters word initially (this will be discussed in depth in 2.2). In Levant Arabic, Salem (2014) claims that /tʃ/ exists and it is not a problem for LA speakers.

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[3] Levant Arabic is spoken by people living in Lebanon, the west of Syria, the northwest of Jordan and the central area of Palestine (Salem, 2014).

In addition to this, the fricative /ʒ/ does not exist in NA but exists in English. Kopczynski and Meliani (1993) mention that the pronunciation of fricative /ʒ/ differs from one Arabic region and dialect to another. They find that it can be realised as either [ʒ], [g], [d], or [j]. In NA, [ʒ] is produced as [dʒ] in words like <measure> /ˈmɛʒər/ [midʒer].

/l/ and /ɫ/ occur in both English and NA. Arabic /l/ is observed by Al-Ani (1970) and Shaheen (1979) to be realised as a voiced dental lateral consonant where Arabic [ɫ] is used only in certain words like [əɫɫa:h] 'God'. On the other hand, English /l/ is a voiced alveolar lateral approximant with many allophones, which are governed by accentual as well as contextual factors (Khattab, 2002). In English, the 'clear' (non-velarised) [l] tends to occur mainly in the onset position, as in ('lip' [lɪp] and 'blow' [bləʊ], whereas the dark [ɫ] occurs in coda and syllabic positions, as in 'peel' [pi:ɫ] and 'table' [teɪbɫ̩] (Cruttenden, 2001).

Another consonant which differs in the two languages is /r/. In Arabic, Shaheen (1979) defines it as a tap or a trill depending on whether it is single or geminate. Khattab (2002) clarifies that, when this sound is single, it is produced as a tap, as in [baɾa] 'he sharpened', but as a trill when it is a geminate, as in ['bara:] 'outside'. In English, /r/ is pronounced as a voiced alveolar or post-alveolar approximant [ɹ] in most English varieties except, for example, when the tap [ɾ] is found in some northern English varieties (Khattab, 2002). This difference leads Arabic speakers in general and Najdi learners specifically to replace the English /ɹ/ with the native Arabic /r/.

To summarise, by comparing the two consonant systems of NA and English, the production of NA-speakers of L2 English could be generally categorised into three categories. The first one is substitution of non-existing consonants into the closet counterpart, as in /ʒ/ to [dʒ] in /miʒer/ → [midʒer] 'measure'. The second includes consonants such as /p/ and /tʃ/. The latter, /tʃ/, is easier to produce as an onset, as in /tʃæptər/ → [tʃæptər] 'chapter', but its difficulty is greater in the coda /ti:tʃ/ → [ti:ʃ] 'teach' (Alqarni, 2013). The former, /p/, seems to be considered an allophone of another existing phoneme, /b/, particularly if it occurs before a voiceless consonant, as in /kata**b**t/ → [ka.ta**p**t] 'I wrote' or clitic-word final position as in /ba:**b**.kabi:r/ → [ba:**p**.kabi:r] 'a big door' (Watson , 2002). The third category includes Arabic-accented sounds such as /ɹ/→ /r/.

In the following section, the focus will be on the vowel inventory systems of the two languages.

2.1.3 *The Vowel Inventory Systems of NA and English*

Crosslinguistically, vowels are considered to be the most significant element in a syllable (Abboud, 1979; Selkirk, 1981; Jarrah, 1993; Ingham, 1994; Watson, 2007). This is true for the Arabic language since many scholars (such as Al-ani (1970), Abu-Mansour (1978), Abboud (1979), Selkirk (1981), Ingham (1994), Kiparsky (2003), and Alotaibi and Hussein (2010)) find that a vowel is the only element that can occupy the nucleus of a syllable in Classical Arabic as well as in other dialects, including NA.

Abboud (1979), Al-Sweel (1987, 1990), Ingham (1994), and Alotaibi and Hussein (2010) observe that the vowel inventory of NA has eight vowels. Three long vowels: open [aː], close back [uː], and close front [iː], and short equivalents [a], [u] and [i], respectively (Alotaibi and Hussein, 2010). In addition, Abboud (1979) and Ingham (1994) mention that there are also two long vowels that have no short counterparts, /oː/ and /eː/. The total number of short and long monophthongs is eight. Figure 2-1 shows vowels of NA and the English language.

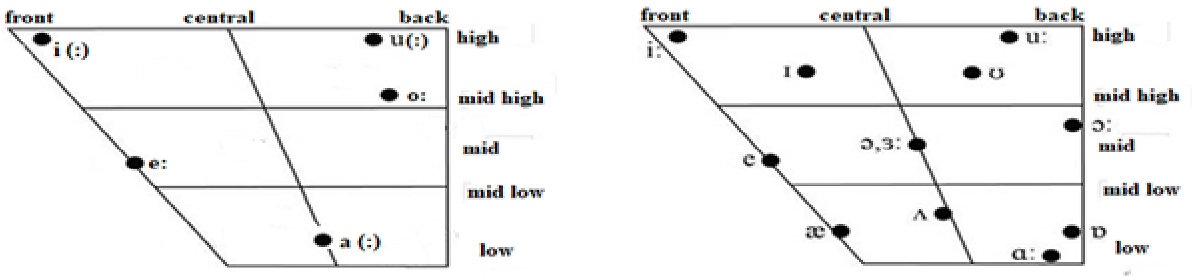

Figure 2-1: Vowel charts of NA (based upon Abboud (1977), Ingham (1984), and Alqahtani (2014)) and English (Roach, 2004)

The two vowel systems show that NA has a much simpler system than the English language has. As mentioned earlier, NA has only eight vowels, /iː, i. eː,æː, æ oː, uː, u/, whereas English has twelve, /i, ɪ, e, ɛ, æ, ə, o, u, ɔ, ʊ, ʌ, ɑ / (Roach, 2004). We can find that back and central areas have the majority of these differences. Kopczynski and Meliani (1993) mention that the vowels which are similar in articulation in English and Arabic do not cause a problem in L2 phonological acquisition. The problem seems to be greater when a vowel does not exist in the native vowel inventory system. Hence, Arabic learners solve the problem of a non-existing vowel by approximating it into the closest vowel in the native language. For example, in the case of the English vowel /ɑ/, Arab learners can make recourse to the allophone [ɑ] of their native language /æ/. So, these two different phonemes in English are considered as two allophones of the same phoneme for Arab learners. Similarly, both Best (1994) and Flege (1995) agree that the sounds which are ‘new’, those which do not exist in the L1, will be difficult to perceive in the L2, but sounds which are similar to a learner’s L1 but not the same in the L2 will be the most difficult to master.

2.2 The Syllable Structure of the NA

Since syllable structure is the central point of the present research and because participants’ L1 literacy levels vary, this section starts by defining the term ‘syllable’ in section 2.2.1 and the discussion goes on to introduce the syllable structure of the NA dialect in section 2.2.2. Considering NA is the mother tongue of all the participants and the only known syllable structure for the non-literate learners (recall that this study has three groups: (1) Non-literate Picture Group, (2) Literate Picture Group, and (3) Literate Word Group (tested twice). The syllable structure, in some instances, will be compared to that of the syllable structure of Modern Standard Arabic, since it is a well-known syllable structure for literate learners who have spent at least six years studying MSA fundamentals (a detailed explanation of participants’ literacy levels will be given in Chapter 4, section H3). Then, Prosthesis is discussed in 2.2.3. In addition to this, since English is the target language in this study, the syllable structure of English will be briefly presented in 2.2.4. Then, factors triggering epenthesis, i.e. the CV syllable as a universal and the Sonority Sequencing Principle (SSP) will be discussed in 2.3, followed by the identity of the epenthetic vowel in 2.3.6. Section 2.3.7 provides a conclusion to the chapter.

2.2.1 *What is a syllable?*

The syllable (σ) has played an important role in the development of phonological theory. It is a fundamental unit that seeks to explain various phonotactic and phonological processes. The sSyllable is defined by Blevins (1995, p.207) as “the phonological unit which organises segmental melodies in terms of sonority”.

The internal structure of the syllable is divided by scholars such as Selkrik (1982) and Clements (1990) into three main constituents: (1) the onset, (2) the nucleus, and (3) the coda. The nucleus and the coda form the rhyme, as shown in Figure 2-2 below.

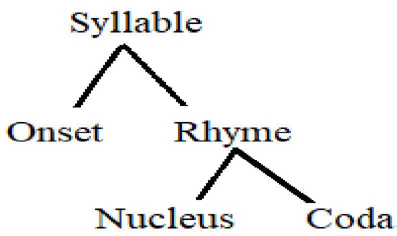

Figure 2-2: Syllable internal structure

The syllable in Figure 2-2 consists of an optional onset followed by a rhyme (nucleus and coda). The onset, which is the first component of the syllable, can be a single consonant or consonant cluster. The nucleus, which is the vocalic part, is the only obligatory element in the syllable. The final consonant or consonant clusters form the coda.

In the 1980s, Hyman (1985), Hayes (1985, 1989), and Broselow (1995) introduced Moraic Theory which is a weight-based theory. Hayes (1985) mentions that mora (μ) is a unit in the syllable's weight which distinguishes between light and heavy syllables. A monomoraic syllable, with a single mora, is a light syllable, while a bimoraic one, which contains two moras, is a heavy syllable. In light of this theory, short vowels are assigned as monomoraic (light) but long vowels are assigned as bimoraic (heavy). Depending on the language, regarding consonants, a single consonant is not moraic while a double consonant (geminate) consonant is moraic. For the former, a single consonant, according to Weight-By-Position, becomes moraic if it functions as a coda (Hayes, 1989). In light of this, syllables can be determined as either 'monomoraic' (light), 'bimoraic' (heavy), or even 'trimoraic' (superheavy). The following representation in Figure 2-3, introduced by Hayes (1995, p.52), shows the assignment of moras.

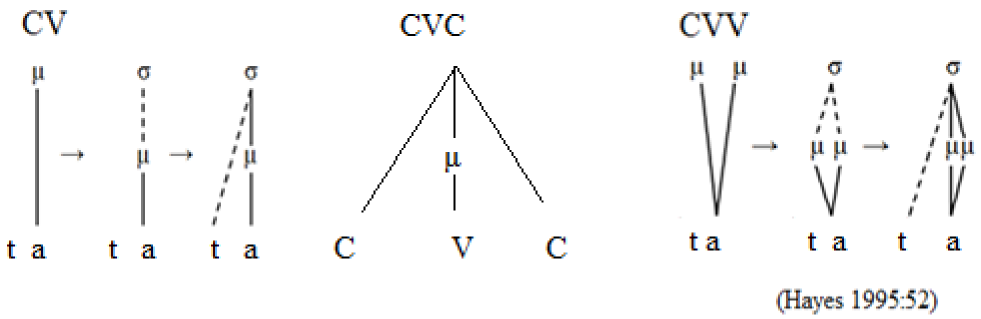

Figure 2-3: Representation of CV, CVC and CVV (Hayes 1995, p.52)

For prosodic structure, which represents units larger than the syllable, the Prosodic Hierarchy has been proposed. It has four main constituents, which are the prosodic Word, Foot, Syllable, and Mora (McCarthy and Prince, 1986; Selkirk, 1980, 1996), as shown below:

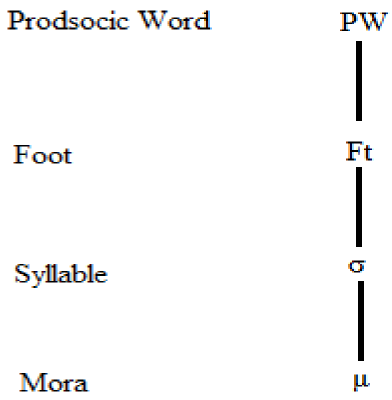

Figure 2-4: Prosodic Hierarchy (McCarthy and Prince, 1986; Selkirk, 1980, 1996)

In the Prosodic Hierarchy, each element is dominated by a higher domain. The mora, which is the smallest component, is dominated by the syllable which is a higher constituent. The syllable, which has at least one mora, is dominated by the foot. The Prosodic Word can comprise many feet, and a single foot can function as a Prosodic Word (McCarthy and Prince, 1986).

Segments are arranged in a way that obey the sonority scale, which represents the sonority values of segments within the syllable. This idea will be explained in sub-section 2.3.2.

2.2.2 *Syllable Structure of NA*

In the syllable of the NA dialect, an onset of at least one consonant must be found in all Najdi syllable patterns (Abboud, 1979; Ingham, 1994; Alezetes, 2007; Alqahtani, 2014). This onset should not have more than one consonant except in a word's initial position. Ammar and Alhumaid (2009) state that the main syllable structure in NA is CVC, with the availability of being double closed (CVCC) in some syllables, which means it has two final consonants as a cluster. So, while the coda of the syllable in the CVC and CVVC patterns contains one consonant, in CV and CVV patterns there are no consonants, and there are no more than two consonants in a CVCC pattern.

According to Abboud (1979), however, a bi-consonantal cluster in Najdi Arabic occurs in word-initial (as in [kra:ʕ] ‘leg’) and word-final (as in [ʃarg] ‘east’), but not in word-medial position (more examples can be found in Table 2-3). In fact, Abboud’s (1979) paper is one of the oldest studies which observes the phonological features of the Najdi dialect, although the primary focus of his paper was on Najdi verbs. Later, Ingham (1994) agreed that the Najdi syllable structure has some different features that distinguish it from other Arabic varieties including Modern Standard Arabic. One major difference is that initial clusters are permissible in NA in such examples as ([kti.bat] ‘she wrote’ and [gru:ʃ] ‘coins’), unlike in MSA where these are not permitted.

According to Jarrah (1993; 2013), CV, CVV and CVC occur more often than other syllables. They also occur word-initially, word-medially or word-finally, so there are no constraints of any kind on their distribution, i.e. they occur at any position. CV is more frequent than CVC and the other syllables. On the other hand, CVV has some constraints placed on its distribution. In comparison to CV and CVC, the CVV type is more frequent in medial position than in initial or final positions. The CVCC type sequence is much less natural.

Based on the combination of what has been mentioned above, the syllable structure of NA can be formulated as (C) CV (V) (C) (C). Table 2-3 below shows examples:

Table 2-3: The Syllable Structure of NA

The Syllable Structure	Example	Translation
CV	[ˈ**ga**.bur]	Grave
CVC	[ˈ**ham**]	Sadness
CVV	[ˈ**da:.**kin]	Dark
CVVC	[ga:m]	He stood
CVCC	[gird]	Monkey
CCV	[**kti**.bat]	She wrote
CCVC	[**tkal**.lim]	'You are talking'
CCVV	**[zba:**.lah]	'Trash'
CVVCC	[ħa:d:]	Sharp
CCVVC	[nsu:r]	'Eagles'
CCVCC	[smint]	'Cement'

Syllable types for NA shown in Table 2-3 can be divided into light, heavy, and super heavy syllables. CV and CCV are light syllables while the heavy syllables are CVC, CVV, CCVC, and CCVV. The super heavy syllables are CVVC, CVCC, CCVVC, and CCVCC.

Looking at Table 2-3 above, it can be observed that all syllables have either single or complex onsets (single onsets - at least - are obligatory in NA) while codas are optional. For example, CV, CCV, CCVV, and CCV do not require codas. In the following sample, Najdi syllable structure is accepted in 'a' and 'c' but not 'b', since two-consonant clusters in the NA dialect are not permitted word-medially.

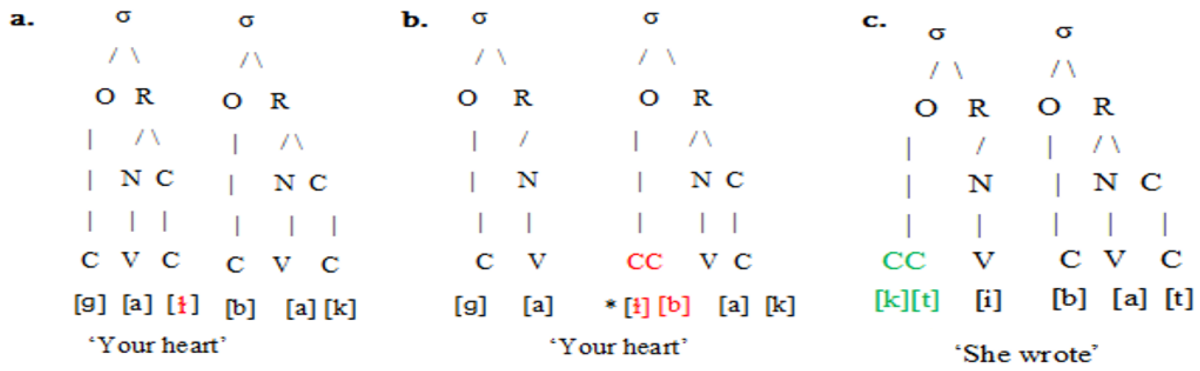

Figure 2-5: Sample of NA syllable structure (based upon Abboud (1979), Ingham (1994), Jarrah (2013), and Alqahtani (2014))

According to Abboud (1979), syllable boundaries in Najdi Arabic are highly predictable. When a consonant can be syllabified as an onset or as a coda of the following syllable, this consonant is always syllabified as an onset. In terms of word-medial two-consonant clusters, the syllable boundary separates the two consonants, making the first member of the consonant cluster a simple coda and the second a simple onset.

In NA, the glottal stop is used in the initial position of a word. It is used to avoid the formation of onsetless syllables, which are not permitted in this specific dialect. For instance, in a word like [ʔakil] 'food', the deletion of [ʔ] leads to the omission of an onset which is not allowed in NA and furthermore disobeys the Onset Principle (Itô, 1989) which states that onsetless syllables should be avoided. Abboud (1979) notes that the glottal stop in the initial-position is found in many Arabic dialects to avoid onsetless syllables, as in [ʔa.mar.na] 'we ordered'.

In conclusion, three considerations should be taken into account when talking about the syllable structure of NA: onsetless syllables, complex onsets, and codas. Firstly, onsetless syllables are not permitted; regardless of the position of the syllable in NA, it has to have an onset. Secondly, complex onsets are permitted in word-initial position only. Finally, codas, if there are any, could be either single or complex (double consonant).

2.2.3 *Prothesis in NA*

Prothesis is known as adding a new element (consonant or a vowel) or a syllable to the beginning of a word (Sampson, 2010). Phonologists (such as Abboud (1979), Kiparsky (2003), Watson (2007), and Rakhieh (2009)) state that complex onsets are not allowed in many dialects of Arabic. Abboud (1979) and Al-Mohanna (1998) find that prothesis is motivated by a word-initial cluster which is found in verbs derived from 'binyans' of the form /ftaʕal/, /nfaʕal/ and

/stafʕal/. Binyans (or triliteral verbs) according to Wright and Caspari (2011) are verb forms that have three radical letters. By looking at the form /nfaʕal/, for example, the 'triliteral' root is f-ʕ-l while /n/ is an affix. Similarly, the root in /stafʕal/ is f-ʕ-l while the affixal root is /st/ and the same is true for /ftaʕal/ where /t/ is an infix while the root is f-ʕ-l (McCarthy, 1981). In the following examples, the author will discuss some previous studies on how word-initial clusters derived from /nfaʕal/, /stafʕal/ and /ftaʕal/ lead to prothesis.

The first study was conducted by Abboud (1979) who focuses on how some verbs in the Northern region of NA trigger prothesis and the second was conducted by Al-Mohanna (1998) who studied how complex onsets in Urban Hijazi Arabic (UHA) promote prothesis. They agree that triliteral verbs such as /nfaʕal/ consist of initial two-consonant clusters which provoke prothesis, an insertion of a glottal stop followed by an epenthetic vowel to avoid an onsetless syllable. Hence, derived verbs from triliterals allow prothesis, as shown in Table 2-4 below.

Table 2-4: → [ʔi] in Northern NA verbs

/nkisar/	[**ʔi**nkisar]	'got broken'
/stagal/	[**ʔi**stagal]	'he received'
/staʕmal/	[**ʔi**staʕmal]	'he consumed'
/staktab/	[**ʔis**.tak.tab]	'cause to write'

It is clear from the examples given that certain types of word-initial two-consonant clusters in some verbs provoke prosthesis in the Northern NA dialect. According to Abboud (1979), the clustering of /nk/ (a nasal followed by an obstruent) in /nkisar/ → [**ʔi**nkisar] as well as the clustering of /st/ (voiceless fricative followed by a voiceless stop) in /staʕmal/ → [**ʔi**staʕmal] 'he consumed' are not permitted in NA. Therefore, prothesis is a strategy used as a solution for this clustering resulting in [**ʔi**nkisar] and [**ʔi**staʕmal].

The next subsection briefly overviews the syllable structure of the English language.

2.2.4 *Syllable Structure of English Compared to Najdi Arabic*

English has quite a different syllable structure system to that of the NA dialect, since English has an optional onset, obligatory nucleus-rime and an optional coda. In the onset position, syllables can begin with one consonant as in ‘be’ /bi:/, two consonants as in ‘try’ /tɹai/, or three consonants as in ‘spray’ /spɹeɪ/or with only a vowel as in ‘I’ /ai/. In the coda, English also allows up to four-consonant clusters as in ‘texts’ /tɛksts/ (CVCCCC).

The syllable in English, as in Arabic, can be classified as either closed or open. When the syllable ends with a consonant it is closed and when it ends with a vowel it is open. In comparison to Arabic, a wide variety of syllable types are permitted in English. In Table 2-5 below, examples of English syllables are presented. extracted from the words chosen for conducting this study, as we will see later in Chapter 4 section 4.5.

Table 2-5: English syllable structure (Aslam and Kak, 2007)

Syllable	Example	Word
CV	/bi:/	Be
VC	/eg/	Egg
CVC	/bɪl/	Bill
CVCC	/hɔ:rs/	Horse
CCV	/skʌɪ/	Sky
CCCV	/spɹeɪ/	Spray
CVCCC	/tɛkst/	Text

In each of the two languages, a consonant sequence that could form a consonant cluster has some restrictions. In English, for example, the /CCC/ sequence always has /s/ as the first member of the consonant cluster followed by one of the voiceless stops /k/, /t/ and /p/ as the second member of the consonant cluster, followed by one of the glide or liquid consonants /r/, /w/ and /j/ as the third and final member of the consonant cluster as in /spɹeɪ/ → ‘spray’, /stɹi:t/ → ‘street’, and /skweɹ/ → ‘square’.

In addition, a sonorant consonant in English can function as the nucleus of a syllable when it is syllabic. For example, words such as button, hassle and trouble are less likely to be pronounced as ?[bʌtən] for 'botton', ?[hʌsəl] for 'hussle' and ?[tɹʌbəl] for 'trouble' but as [bʌt.n̩], [hʌs.l̩] and [tɹʌb.l̩], respectively (Aslam and Kak, 2007). The most common syllabic consonants, according to Aslam and Kak (2007), are [n̩] and [l̩].

Wilkins (1972) observes that if the system of the second language differs from the system of the learners' first language, L2 learners face difficulties and will make errors in their L2 performance. Therefore, it is supposed that NA speakers learning English will encounter learning difficulties when learning a syllable structure more marked than in their L1.

The following section discusses factors that motivate epenthesis.

2.3 **Factors Motivating Epenthesis**

The preference for a CV syllable and sonority sequencing are assumed to play an essential role in preferable syllables by L2 learners. In the following subsections, the CV syllable as a universal syllable will be discussed in 2.3.1 and then 2.3.2 will discuss the relation between syllables and the sonority hierarchy. The role of sonority in epenthesis 'equal sonority', 'rising sonority' in the coda will be firstly discussed in 2.3.3 and 2.3.4. Then, the relation of sonority and consonant clusters in the onset will be presented in 2.3.5 followed by the identity of the epenthetic vowel in section 2.3.6.

2.3.1 ***The CV Syllable as an Absolute Universal***

Evidence for preferring shorter syllable margins exists from phonological processes found in many languages where syllable margins are reduced by either vowel epenthesis or consonant deletion. This evidence has led many scholars to agree that the CV syllable is an absolute universal in languages (such as Vennemann (1988), Clements (1990), and Carlisle (2001)).

Carlisle (2001) mentions that the CV syllable is "an absolute substantive universal; all languages have CV syllable, and some have only CV syllables" (p.5). Carlisle adds that if a syllable is more complex than a CV, it is a marked syllable. One of the earliest L2 acquisition studies conducted on syllable modification was by Tarone (1980), who transcribed the production of two Portuguese, Cantonese, and Korean learners of English. Participants in the study were found to modify 20% of the total number of syllables they produced (137 syllables in total) either by deletion, glottal stop insertion or epenthesis. In most cases of modification, it was interpreted that these modifications were due to preference for a CV syllable.

Vennemann (1988) clearly expresses the idea that only one C is the optimal onset and a zero C is the optimal coda. Vennemann mentions a number of historical cases in which onsetless syllables (V syllables) obtained a single consonant as onset creating CV syllables. He mentions some Italian examples:

Table 2-6: V → CV (Vennemann, 1988)

vi.du.a	→ ve.do.va	'widow'
ru.i.na	→ ro.vi.na	'ruin'
pa.du.a	→ pa.do.va	A name of a city

As seen in the previous examples, syllables that only have a high back vowel are adjacent to the consonant /v/ which acts as a single onset.

In addition to developing V syllables to become CV syllables, Vennemann finds that languages reduce CCV syllables to become CV syllables. From his research on German language data, he mentions that Early Old High German (OHG) had complex onsets containing /h/ followed by a consonantal sonorant. The initial /h/ had disappeared in late OHG, resulting in single onsets, as shown in Table 2-7:

Table 2-7: CCV → CV in OHG (Vennemann, 1988)

Early OHG	Late OHG	
Hnigan	Nigan	'to bow'
Hlut	Lut	'loud'
Hwiz	Wiz	'white'

Vennemann adds further examples from different languages for syllables being reduced from CCV to become CV. From Pali, an Indian language, for example, he mentions examples such as /ambra/ → [amba] 'mango' and /syandana/ → [sandana] 'wagon' (Vennemann, 1988).

From Vennemann's (1988) examples, creating CV syllables from either V syllables in addition to omitting the complex onset cluster in CCV syllables to become CV syllables means that a CV syllable is a universally preferable syllable for L2 learners.

2.3.2 ***Sonority Sequencing Principle***

Cross-linguistically, scholars have noted that segments in syllables are gathered into different groups depending on their hierarchic interrelations. This hierarchic interrelation is known as *Sonority Scale* or *Sonority Hierarchy* by scholars (e.g. Selkirk (1984), Clements (1990), Parker (2002, 2008)). The term 'sonority' is defined by Ladefoged and Johnson (2011, p.245) thus: "sonority of a sound is its loudness relative to that of other sounds with the same length, stress, and pitch".

The peak of sonority in syllables characterises the most sonorous segment, which is bordered by marginal segments such as onsets and codas. Scholars like Hooper (1976), Selkirk (1984), Clements (1990), and Butt (1992) have conducted studies designed to create a universal sonority hierarchy. The universal sonority scale is presented in Figure 2-6 below, where vowels are the most sonorous and obstruents are the least.

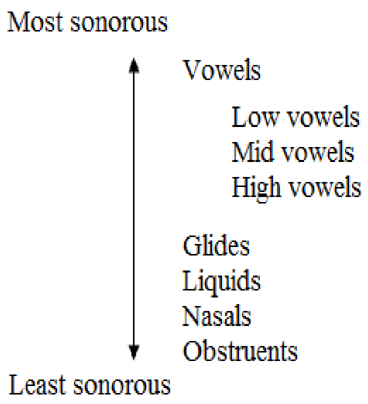

Figure 2-6: Universal sonority scale

Stops and fricatives are considered to form a single class in relation to the sonority scale (Clements, 1990). However, Selkirk (1984) and Butt (1992) have argued that voiceless obstruents are less sonorous than voiced ones and stops are less sonorous than fricatives, as shown in Figure 2-7.

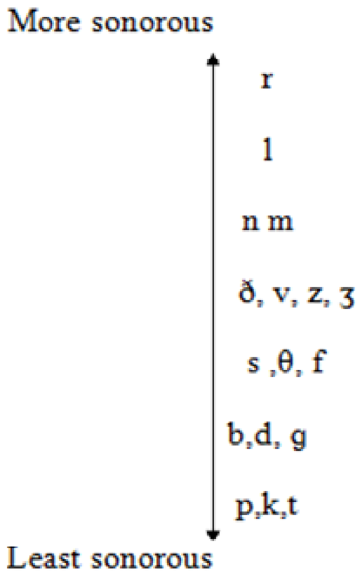

Figure 2-7: Obstruents

In addition to this, although affricates are considered to belong to the obstruent family, they are not included in the sonority scale above. In fact, Parker (2008, p.58) argues that "[a]ffricates cross-linguistically pattern with plosives and fricatives", and he mentions that affricates are ranked between plosives and fricatives. Later, Parker (2011) states that "the placement of affricates between stops and fricatives is a controversial issue, remaining open to disagreement" (p.14). Parker justifies including them in a sonority scale based on four main points: (1) universality, as it could be applied to all languages; (2) exhaustivity, as it should include all speech sounds; (3) impermutability, as ranking should not be reversed; and (4), it should be phonetically grounded 'measurable'. In the discussion, regarding point 1 Parker mentions that it is necessary to establish a unique, single sonority scale that covers all known language. For exhaustivity, Parker insists that every phonological segment has to be included, mentioning that many hierarchies ignore natural classes such as affricates and glottal consonants (/ʔ/ and /h/). For the third point, rankings should not be changed in the sonority scale. Impermutability, according to him, reduces the danger of circular argumentation. For the fourth point, sonority is usually based on concrete articulatory/acoustic gestures.

Based on the universal sonority scale in Figure 2-6 above, and the sonority scales that rank affricates in the middle, Parker (2011) presents the comprehensive sonority scale, which ranks affricates lower than fricatives and higher than stops, as shown in Table 2-8 below.

Table 2-8: Comprehensive sonority scale (Parker, 2011)

MOST SONOROUS

	low vowels
	mid peripheral vowels
	high peripheral vowels
	mid interior vowels
	high interior vowels
	glides
	rhotic approximants [ɹ]
	flaps
	laterals
	trills
	nasals
	voiced fricatives
	voiced affricates
	voiced stops
	voiceless fricatives including [h]
	voiceless affricates
	voiceless stops including [ʔ]
LEAST SONOROUS	

The relation between sonority and syllable structure has attracted many linguists, such as Abdul-Karim (1980), Jarrah (1993), Ingham (1994), Rakhieh (2009), and Ibrahim (2012). They agree that there is a connection between sonority and syllable structure in which sonority rises from the onset upwards to a peak and falls towards a coda boundary. This means that the sonority process looks like a curve going upwards to a peak and falling towards a coda. Nonetheless, they note that some syllable types that contain initial (onset) or final (coda) bi-consonantal clusters violate the *Sonority Sequencing Principle* (SSP). This behavior was firstly discovered by Clements (1990), who mentions two manners of violation of sonority: *Plateau Sonority* and *Reverse Sonority*.

According to Clements (1990), Blevins (1996), and Carlisle (2001), *Plateau Sonority* is meant to describe two members of a consonant cluster, either in the onset or coda position, which are equally sonorous. *Reverse Sonority* describes a consonant cluster in which its peripheral segments in onsets or codas are more sonorous than those closer to the nucleus.

In the case of NA, coda clusters of the super-heavy syllable type CVCC, for example, are permitted in certain situations but prohibited in others. It is believed that the SSP motivates where epenthesis occurs. Ingham (1994) finds that the epenthetic vowel separates the two members of the consonant cluster, resulting in a disyllabic from a monosyllable. He mentions that syllables having two consonant clusters ending with one of the sonorant consonants (/r/, /l/, /w/, /j/ and /n/) are broken up by the epenthetic vowel.

In the following sub-sections, the author will describe the cases in which epenthesis is used to avoid sonority violations starting with coda position since this position in NA in terms of SSP differs from that in onsets. In 2.3.3 the author will start with equal sonority, where the author will divide clusters of this type into equal sonority obstruents and sonorants. Then, in 2.3.4, the author will discuss the rising sonority in NA and, in the final sub-section, 2.3.6, the author will briefly introduce the identity of the epenthetic vowel in NA.

2.3.3 ***Equal Sonority in the Coda***

The equal sonority clusters seem to be divided into two groups: equal sonority obstruent clusters and sonorant clusters. NA permits the clusters of the first type but does not allow the second type. The data in Table 2-9 are divided into equal sonority obstruents in (a) and equal sonority sonorants in (b).

Table 2-9: Equal sonority in the coda

		Cluster Pattern	**MSA**	**NA**	**Meaning**
a	Equal Sonority: Obstruents	fricative - fricative	/nafs/	[nafs]	soul
		stop – stop	/ʕaqd/	[ʕagd]	contract
		fricative – stop	/safk/	[safk]	shed
		stop - fricative	/waqf/	[wagf]	endowment
b	Equal Sonority: Sonorants	nasal – nasal	/ʔamn/	[ʔa.min]	safety
		nasal – nasal	/samn/	[sa.min]	oil
		nasal – nasal	/ðˤimn/	[ðˤi.min]	inclusive

Looking at the data in Table 2-9, equal sonority obstruent clusters as in [nafs] 'soul', [ʕagd] 'contract', [safk] 'shed' and [wagf] 'endowment' are permitted by NA while equal sonority clusters containing sonorants such as /ʔamn/ → [ʔa.min] 'safety', /samn/→ [sa.min] 'oil' and /ðˤimn/→ [ðˤi.min] 'inclusive' are not allowed.

In other words, the monosyllabic words in (b) become di-syllabic because final consonant clusters are equal in sonority and both of these segments are sonorants. This violation of SSP is broken up by an epenthetic vowel, i.e. /CVCC/→ [CV.CVC]. It is stated earlier that this violation of sonority is called a 'Sonority Plateau' in which both of the members of the cluster are equally sonorous (Clements, 1990). This observation is supported by Carnie's (1994) study, which was conducted on Modern Irish, as well as the study of Bat-Ei (2012), which was conducted on Hebrew consonant clusters. Both of their findings indicate that consonant clusters of equal sonority containing sonorants are not permitted to occur in these languages where clusters of equal sonority obstruents are permitted.

In sum, when two members of consonant clusters are equal in sonority, obstruents are not broken by an epenthetic vowel but epenthesis occurs if these consonants are equal sonorants.

2.3.4 *Rising Sonority in the Coda*

NA prohibits the coda of a super heavy syllable if it goes against the SSP. This type of violation of sonority is mentioned by Clements (1990), who describes it as Reverse Sonority. According to him, the consonant closer to the nucleus is less sonorous than the outer consonant. This type of Reverse Sonority is applicable for the consonant cluster for both positions (onset or coda). Thus, this leads NA speakers to insert a vowel to separate the rising sonority consonants and make the syllable obey sonority. Before discussing this in more detail, the author will introduce examples from NA, as shown in Table 2-10 below.

Table 2-10: Rising sonority in the soda position

Cluster Pattern	MSA	NA	English Meaning
Nasal – Liquid	/naml/	[na.mil]	ants
Nasal – Liquid	/xamr/	[xa.mur]	wine
Fricative – Nasal	/dafn/	[da.fin]	bury
Nasal – Glide	/ramj/	[ra.mij]	throwing
Fricative – Liquid	/naʃr/	[na.ʃur]	publication
Fricative – Liquid	/ħafl/	[ħa.fil]	party
Stop – Nasal	/tibn/	[ti.bin]	hay
Stop -Liquid	/ħabl/	[ħa.bil]	rope
Stop –Liquid	/sˤabr/	[sˤa.bur]	patience

The canonical shape of all words mentioned above in MSA is CVCC monosyllabic, but the epenthetic vowel has separated the two members of the final cluster in NA to become disyllabic. The word list in Table 2-10 has final clusters that violate the SSP where the consonant closer to the nucleus is less sonorous than the peripheral consonant. For example, when a fricative followed by a liquid as in /ħafl/ → [ħa.fil] ‘party’ or a stop followed by a liquid as in /sˤabr / → [sˤa.bur] ‘patience’, the epenthetic vowel insertion results in resyllabification where the first member of the consonant cluster becomes the onset of the new syllable; the epenthetic vowel is the nucleus of the syllable and the second member of the consonant cluster is the coda of the newly-created syllable.[4] Similarly, this is seen in 'Sonority Plateau' in Table 2-9, i.e. /CVCC/→ [CV.C**V**C].

2.3.5 *Consonant Clusters and Sonority in the Onset in NA*

In section 2.2, it was shown that an onset with at least one consonant is required in NA in all positions of the word, including a double consonant in word-initial position, while onsetless syllables are prohibited. Two-consonant clusters word-initially are allowed in NA as a result of two phonological processes. Firstly, an unstressed high short vowel is deleted in open syllables in such examples as /ħi.ba:l/→ [**ħb**a:l] 'ropes' (Alqahtani, 2014; Salem, 2014) (more examples are given in Table 2-11). The second phonological process that leads to the formation of two-consonant clusters word-initially in NA is the deletion of the vowel when it becomes the nucleus of the antepenultimate syllable in the case that it is followed by a light penultimate syllable. This phonological process is termed as 'trisyllabic elision' by scholars such as Sakarna (2005) and Rakhieh (2009). For example, in a word like /ba.ga.rah/→ [**bg**a.rah] 'cow', the vowel in the light antepenultimate syllable is deleted to minimize the number of light syllables (Sakarna (1999, pp.47-48).

As discussed earlier in section 2.3.2, consonant clusters are ordered in a manner that obeys the Sonority Sequencing Principle in which the sequence is arranged from the least to the most sonorous (see Table 2-8). This means that the sequence of the consonants in the onset should rise towards the nucleus in which each C in the onset must be higher in sonority than the preceding one and lower than the following one (Selkirk, 1984). This arrangement, according to Clements (1990), is sometimes violated in two manners: *Plateau Sonority* (two members of the Cs are equally sonorous) and *Reverse Sonority* (the first C is more sonorous than the second C).

NA seems to allow the sequence of two consonants regardless of whether they obey the sonority or not. In the following examples, the author will discuss firstly two-consonant clusters in NA that obey SSP in Table 2-11, then how they violate it in Table 2-12. Examples are adapted from Alqahtani (2014) and Salem (2014).

[4] It is notable that the identity of the epenthetic vowel in [ẖa.fil] differs from that in [sˤa.bur]; a brief explanation of the identity of the epenthetic vowel will be given in section 2.3.6.

Table 2-11: Examples of two-consonant clusters with respect to SSP in onsets in NA

Cluster Pattern	MSA	NA	Meaning
affricate-liquid **/dʒl/**	/dʒu.lu:d/	[**dʒl**u:d]	skins
stop-liquid **/bl/**	[bi.la:d]	[**bl**a:d]	countries
fricative-nasal **/sl/**	[si.laħ]	[**sl**a:ħ]	weapon
nasal-liquid **/mr/**	/mu.ra:.sil/	[**mr**a:sil]	messenger

In Table 2-11, in [dʒlu:d] as an example, the first C is less sonorous than the second C. The formation of this type of consonant cluster obeys the sonority, as seen in Table 2-8. When looking at the underlying form (MSA) in [dʒlu:d], [**bl**a:d] and [**sl**a:ħ], the vowel of the first syllable is deleted due to the fact that it functions as the nucleus of a light unstressed syllable. The phonological process which led to forming CC in the onset in the last word [**mr**a:sil] is 'trisyllabic elision' to reduce the number of light syllables.

Alghmaiz (2013) investigates how many sonority distance steps between the two segments is allowed in NA. He finds that consonant clusters with one, two and three sonority distance steps are permitted in NA, such as in /tu.ra:b/ → [**tr**a:b] 'soil'. In the following examples in Table 2-12, the author will show two-consonant clusters in NA that do not obey SSP.

Table 2-12: Examples of two-consonant clusters with SSP violation in NA

Cluster Pattern	MSA	NA	Meaning
liquid - fricative as in /rf/	/ru.fu:f/	[**rf**u:f]	shelves
nasal glottal stop as in /mʔ/	/mu.ʕat.tem/	[**mʕ**at.tem]	dark
stop - stop as in /kt/	/ku.ta:b/	[**kt**a:b]	book
fricative - fricative as /ħs/	/ħusˤa:n/	[**ħsˤ**a:n]	horse

As stated earlier, NA seems to allow the formation of consonants regardless of the sonority distance steps. In Table 2-12, in the words /ru.fu:f/→ [**rf**u:f] 'shelves' and /mu.ʕat.tem/ →

[**mʕ**at.tem] ‘dark’, for example, the left elements are more sonorous than the following elements. In the second two words ([**kt**a:b] and [**ħsˤ**a:n]) the two segments in the onset are equally sonorous. This type of clustering violates the sonority hierarchy scale shown earlier in Table 2-8.

The identity of the epenthetic vowel will now be discussed in the following section.

2.3.6 *Identity of the Epenthetic Vowel in NA*

The epenthetic vowels [**i**], [**a**] or [**u**] are inserted to break up the consonant clusters in CVCC syllable type if the two members of the consonant cluster violate SSP (*Reverse Sonority* or *Sonority Plateau*). Choosing an epenthetic vowel among these vowels does not occur haphazardly but is triggered by certain factors; namely, vowel harmony and place of articulation of the adjacent consonants. In the following paragraphs, the author will discuss the environments where the epenthetic vowels [**i**], [**u**] and [**a**] are inserted, as discussed by Jarrah (1993).

Starting with the harmony between the stem vowel and the epenthetic vowel, consider the examples in Table 2-13 below.

Table 2-13: Harmony of the epenthetic vowel

a	/t̠ˤifl/	[t̠ˤi.f**i**l]	child
	/dʒism/	[dʒi.s**i**m]	body
	/nimr/	[ni.m**i**r]	tiger
	/tibn/	[ti.bin]	hay
b	/ð̠ˤuhr/	[ð̠ˤu.h**u**r]	noon
	/sugm/	[su.g**u**m]	ailment
	/ħ̠ukm/	[ħ̠u.k**u**m]	judgment
c	/t̠ˤaʕm/	[t̠ˤa.ʕ**a**m]	taste
	/laħ̠m/	[la.ħ̠**a**m]	meat
	/mah̠r/	[ma.h̠**a**r]	dowry

Looking at Table 2-13, it is clear that the epenthetic vowel in these examples copies the stem vowel. The epenthetic vowel [i] in (a) is determined by the stem vowel /i/, the epenthetic vowel [**u**] is determined by /u/, and [**a**] is determined by /a/. Jarrah (1993) mentions examples of [**i**] epenthesis as in ħibr/ → [ħi.b**i**r] 'ink', and for [u] epenthesis as in /rubʕ/→ [ru.b**u**ʕ] 'quarter'. He finds that the insertion of [**i**] and [**u**] undergoes a progressive harmony due to the vowel melody spread rule. The rule of this harmony is shown below:

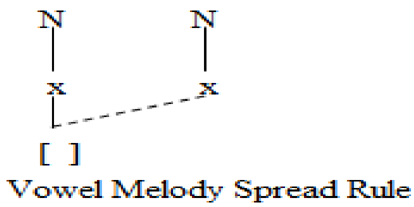

Figure 2-8: Vowel melody spread

The epenthetic vowel [**a**] in (c) is determined by the first consonant of the consonant cluster in the coda position of the CVCC syllable. By looking at the examples, the first member of the consonant cluster has the feature of [+ pharyngeal], which spreads its feature into the adjacent vowel. This generalisation has been mentioned by Jarrah (1993), who supports it by giving examples such as /naχl/ → [na.χ**a**l] 'palm trees' and /laʁm/ → [laʁ**a**m] 'mine'.

On the other hand, the epenthetic vowel in some cases is neither governed by the stem vowel nor is it determined by [+pharyngeal] feature of the first member of the consonant cluster. Hence, if the epenthetic vowel does not copy the stem vowel, Jarrah (1993) proposes that the epenthetic vowels [**i**] and [**u**] are determined by both members of the consonant cluster. To support this finding, he mentions examples such as /ʕagl/→ [ʕa.g**i**l] 'mind' and /ʔakl/→ [ʔa.k**i**l] 'food'. So, the rule could be formulated as follows:

(1). → [i] / [-pharyngeal] __ /l/

Jarrah (1993) adds that the epenthetic vowel [**u**] is inserted between [-pharyngeal] and /r/ in such examples as:

(2). a. /masˤr/ → [ma.sˤur] 'Egypt'

b. /dʒamr/→[dʒa.mur] 'charcoal'

c. /sˤabr/→[sˤa.bur] 'patience'

Now, it is worth introducing the writing system of NA and that of English to see if there is any orthographic differences that possibly affect L2 acquisition that could lead to non-native production. Hence, the two writing systems will be discussed and compared in section 2.3.7 below.

2.3.7 *The Writing Systems of NA and English*

L2 researchers have suggested that the distance between writing systems in the L1 and L2 affects L2 reading acquistion (Koda, 1990; Cook and Bassetti, 2005) but less has been said about how this affects the acquisition of phonology. According to Cook and Bassetti (2005), L2 readers transfer their L1 reading process backgrounds during L2 reading acquisition, taking into consideration that 'graphemes' or 'written symbols' are the smallest unit in the writing system.

Cook and Bassetti (2005) describe the Arabic writing system as 'consonant based-writing' where written symbols are not necessarily linked to every phoneme of speech. The Arabic writing system is not phonologically transparent as it does not normally represent vowels. In fact, consonants in the Arabic language carry the lexical meaning of the word. For example, /drs/ represents the verb 'study', while /ktb/ represents the word 'write'. Non-transparent diacritics [a, i or u] are used as vowels. In 2.1.3 it was mentioned that NA has five (orthographically transparent) long vowels (/iː, uː, aː, oː, eː/). The short vowels, i.e. [i, u, a], are pronounced but are not graphemes, rather they are diacritics.[5] These diacritics are commonly only written in religious texts and in children's literacy texts as they are used in MSA to disambiguate certain words which could carry more than one meaning (see Diab, Ghoneom and Habash, 2007). Diab et al. further note that diacritics in written Arabic can be either fully written (as in the religious context) or partially written (to disambiguate the meaning of a certain word). For example, /ktb/ might carry many meanings depending on the diacritics. It can be produced as < كَتَبْ> [ka.tab] 'he wrote', < كُتُب> [ku.tub] 'books' or < كُتِبْ> [ku.tib] and < كْتِبْ> [ktib] 'was written'.

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[5] There are many diacritics in Arabic language. The ones used above are:
ـَ This is a small diagonal line that if placed above a letter represents the short vowel /a/ as in ⟨دَ⟩ [da] and if it is placed under a letter < ـِ > represents the short vowel /i/ as in ⟨دِ⟩ [di];
ـُ This small curl-like diacritic is placed above a letter to represent the short vowel /u/ as in ⟨دُ⟩ /du/;
ـْ This small circle-shaped diacritic is placed above the letter to indicate that this letter is not followed by any vowel as in ⟨دَدْ⟩ (*dad*).

Arabic orthography, including NA, compared to English orthography, is characterised by its complexity due to the positional variants of the letters, letter ligature, and the consonant and vowel diacritics. Indeed, in addition to the fact that writing directionality is different in the two languages, where Arabic is written from right to left and English is written from left to right, many graphemes in the Arabic language share the same form, where the number of dots above or under the letter distinguish its sound. For example, < ت> corresponds to /t/ and <ث > corresponds to /θ/, which differ only in the number of dots they have; the first has two whereas the second has three. Similarly, < نـ > /n/ and < بـ > /b/ differ only in the position of the dot. An additional feature that distinguishes this orthography is that the majority of the letters vary in shape according to the position of the letter in the word; word-initial, word-medial or word-final. These could be little changes, as in /t̲ˤ/ where it is written < طـ > word-initial, < ـطـ > word-medial and < ـط > word-final or it could be a major change as in /h/; < هـ > word initial, < ـهـ > word medial and < ـه > word final (Habash et al., 2012).

In a few cases there are some exceptions of archaic spellings where even long vowels, 'transparent vowels', could be written but not pronounced, as in < عمرو> 'name of a male' /ʕɑmruː/ → [ʕɑmr] where the vowel /uː/ is written but not pronounced. In other cases, long vowels are not written but pronounced, as in < هذا > 'this' /hðaː/ → [haːðaː], i.e. [aː] is not written but pronounced (Buckwalter, 2010).

Cook and Bassetti (2005) describe the Arabic writing system as a consonant based-writing system where the written symbols are not necessarily linked to every phoneme of speech. The Arabic language is not phonologically transparent as it does not normally represent vowels. In fact, consonants in the Arabic language carry the lexical meaning of the word. Based on this, it is less transparent in writing than in reading since many graphemes can represent the same phoneme (Share and Levin, 1999).

In comparison, English orthography not only differs in the way it is written, from left to right, but it is also characterised by using the Roman alphabetic writing system. Cook and Bassetti (2005) describe English orthography as 'phonologically opaque' when compared to other orthographies which use the Roman alphabet such as Italian, and they note that English requires a complex group of grapheme-phoneme correspondence rules that depend on the speaker's knowledge of grammar.

2.4 Chapter Summary

This chapter has reviewed the phonology and orthography of NA in comparison with that of English, including consonants, vowels, and the syllable structure. A description of the consonant inventories of NA as well as English was briefly given. A comparison between these consonant inventories revealed that English has some phonemes that do not exist in NA. It is believed that the absence of a consonant in the L1, such as /v/in NA, might lead to substituting the sound(s) of the TL into the closest counterpart (/f/ in this case). Some other consonants might be pronounced even if the speaker's consonant inventory does not have this phoneme (as seen for the voiceless bilabial /p/). Watson (2002) notes that the voiced bilabial plosives are devoiced when they occur word-final as in /ba:**b**.kabi:r/ → [ba:**p**.kabi:r] 'a big door' or are adjacent to a voiceless consonant as in /wa**g**t/ → [wa**k**t] 'time'. The vowel inventories of English as well as NA were shown, where English has a more complex system than NA.

In terms of the syllable structure, NA has a syllable structure that differs from that of both MSA and English. Two-consonant clusters word-initial are permitted in NA, in examples such as [**kti**.bat] 'she wrote', but not in MSA. However, word-initial three-consonant clusters are permitted in English in a word such as /spreɪ/ 'spray' and word-finally as in /tɛkst/ 'text' but not in either of the Arabic varieties. The focus then moved to factors that motivate epenthesis such as CV as an absolute syllable and sonority violations. The CV syllable is considered to be a universal syllable in languages where a single C is the optimal onset and a zero C is the optimal coda (Vennemann, 1988).

Sonority Sequencing Principle (SSP) and syllable structure have a connection where the sonority of each C in an onset has to be less than the following C and more than the preceding, but each C in the coda has to be more than the following and less than the preceding one; i.e. it rises up towards the peak and falls towards the coda boundaries (Selkirk, 1984; Clements, 1990; Parker, 2002, 2008). Nevertheless, some syllables that have consonant clusters violate the SSP in two manners: (1) *Plateau Sonority,* and (2) *Reverse Sonority* (Clements, 1990). Onsets in NA do not always obey SSP. In [**dʒl**u:d] 'skins', for example, NA obeys SSP but violates it in [**rf**u:f] 'shelves'. In the coda, NA does not obey SSP when the two segments are equally sonorant obstruents as in [nafs] 'soul', but it prohibits the coda of a super heavy syllable if it goes against the SSP when the two segments are equal in sonority sonorants as in /ðˤimn/ → [ðˤi.min] 'including', or when they are rising in sonority as in /naml/ → [na.mil] 'ants'. This chapter also presented prothesis in NA stating that triliteral verbs provoke prothesis in examples such as [nkisar] → [**ʔi**nkisar] ‘got broken’.

The identity of the epenthetic vowel in NA dialect showed that vowel harmony may occur in any epenthetic vowel in NA but determination by an adjacent consonant occurs only for the epenthetic vowels [**i**] and [**u**].

In terms of orthography, the Arabic writing system is described by Cook and Bassetti (2005) as a consonantal writing system where graphemes are not linked to every phoneme; the system involves a number of diacritics instead, which are not normally used. English, compared to Arabic, has a somewhat more transparent writing system in that all vowels are represented by graphemes.

In the following chapter, the author will firstly review the literature on influences on interlanguage phonology. This will include orthography, where the author will comprehensively discuss the literature on the role of orthography in L2 phonology. This will be followed by a discussion on the role of L1 literacy in L2 acquisition and then by children’s phonological error patterns in their L1.

Chapter 3. Influences on L2 Phonology

This chapter is divided into two main sub-sections. The first sub-section introduces some theoretical background knowledge about L2 phonology along with focusing on OI, which is the main topic of the present thesis. Before discussing issues related to OI, it is necessary to begin with the general theories related to interlanguage phonology (IL). The discussion will be narrowed down to the central discussion. Firstly, the theoretical perspectives on IL in 3.1 will describe two main hypotheses: The Contrastive Analysis Hypothesis (CAH) and The Markedness Differential Hypothesis (MDH). Then, 3.2 will introduce OI and discuss its positive and negative effects. As this study focuses on literacy as a variable, a brief discussion of the impact of adolescents' L1 literacy on L2 acquisition will be introduced in 3.3. Then, section 3.4 will discuss phonological error patterns by children, the only group without literacy whose acquisition of phonology has been studied so far. Section 3.5 concludes the chapter.

3.1 Theoretical Perspectives on Interlanguage Phonology

Effects of native languages on the acquisition of subsequently learned languages has long been of interest to L2 phonologists and has generated a great body of research ever since the first work in this area was undertaken in the 1950s (e.g. Weinreich (1953) and Lado (1957)). From that time, the positive and negative effects of L1 phonology transfer have been considered to influence not only the acquisition of L2 phonology itself but also other domains of SLA such as pragmatics, syntax, and morphology.

Regarding L2 transfer, Zampini (2008) states that although the construct of L2 transfer undoubtedly existed before its documentation in the second language acquisition/SLA literature (as Thomas notes), phonology was most heavily researched because it is more obvious and possibly also more prevalent than the other areas of L2 acquisition. The earliest documented works in this area go back to Fries (1945), Weinreich (1953) and Lado (1957), which led to the development of the Contrastive Analysis Hypothesis (CAH) which simply suggested comparing the L1 and L2 and claimed to predict error production based on where the L1 and L2 differ and no errors where they do not.

3.1.1 *Interlanguage Phonology*

In the early 1970s, the idea of interlanguage was visited. Selinker (1972) made reference to Wenriech's (1953) phenomenon of 'interlanguage identifications', which is what learners do when acquiring a second language. He noted that although many linguistic and psychological questions were asked by Weinriech, he left open the question of what psychological structure is assumed for ‘interlingual identification’. Selinker’s analytical attention was on the utterances produced during the learners’ attempt to produce the TL. These utterances are usually not identical to a target language speaker’s utterances, nor do they only show the influence of the learner’s native language as Lado and others would have hypothesised. Selinker proposes interlanguage, i.e. “a separate linguistic system based on the observable output which results from the learner’s attempted production of the TL norm” (1972, p.214).

Ioup and Weinberger (1987), in their book *Interlanguage Phonology*, state that second language research had been greatly influenced by the advances in generative phonology, where interlanguage phonology became an important area of investigation (e.g. Eckman (1977, 1985)). This, according to them, was also inspired by the recent developments in synchronic and L1 developmental phonology resulting in researchers’ application of the insights to the analysis of L2 data with interesting results, leading in turn to new directions for future explorations. Moreover, the L2 data seemed also to have implications for phonological theory.

When it comes to L2 syllables, starting in the late 1970s and early 1980s researchers investigated L2 learners’ reliance on epenthesis and deletion as syllable ‘simplification strategies’ regardless of their L1. This was first researched by Tarone (1980), who investigated whether universal strategies prevailed in interlanguage (IL) syllable structures. Then, Sato (1984) investigated whether the syllable structure rules of the native language were transferred to the IL. Additionally, Broselow (1983, 1984) and Anderson (1987) investigated how the rules of the native language syllable structure and universal principles such as markedness interacted in shaping the IL syllable structures.

An example that clearly demonstrates L1 transfer CV syllable transfer during L2 acquisition comes from two studies on the English of native Arabic speakers. In the first study, Broselow (1983) investigated syllabification errors of native Arabic speakers of two dialects (Egyptian and Iraqi) learning English. Both dialects have a syllable structure that does not permit consonant clusters in onset position. Yet, Arabic speakers of each dialect modified the target English words with initial complex onsets in a different manner. Egyptian speakers produced words such as <flow> as [f**i**lo] whereas Iraqi speakers pronounced it as [**i**flo]. The Egyptian speakers inserted an epenthetic vowel to the right of the extrasyllabic consonant which they resyllabified to form a CV syllable. In contrast, Iraqi speakers prothesised a vowel to the left of the extrasyllabic consonant to be resyllabified to form a VC syllable. According to Carlisle

(2001), if the CV syllable was a universally preferable syllable, Iraqi speakers would have another reason to pronounce words such as <flow> as [filo], since such a strategy forms a CV syllable independent of L1 transfer. In the second study, Broselow (1984) examined how native English speakers pronounce Arabic words. English speakers resyllabified Arabic to obey the conditions of English syllable structure.

Later in the 1980s, Weinberger (1987) made a connection between the use of a particular strategy and the nature of production tasks and he hypothesised that the strategy is determined by the linguistic context and guided by the universal notion of ‘recoverability’, which is “the ability to recover an underlying representation, no longer apparent at the surface, by reversing the application of the rules and working back from the surface to a unique underlying representation” (p.420). He added that, in context-reduced situations, the learner’s use of epenthesis may be more frequent than deletion, since epenthesis, in comparison to deletion, preserves recoverability. Weinberger’s hypothesis is supported by the findings of a study conducted on four Mandarin students (two males and two females) aged 21-31 years learning English on the intensive ESL program at the University of Washington. They were all of the same placement level and had obtained similar scores in the university’s standardised test. The participants were asked to produce syllable-final consonant clusters in three different settings or task types. Weinberger argues that the L1 syllable structure, the learner’s degree of proficiency, and task type affects the ratio of epenthesis to deletion.

Eckman (1977, 1985) provided an explanation of epenthesis in L2 by the Markedness Differential Hypothesis (MDH). He suggested that some aspects of interlanguage phonology are a result of the markedness of the structures rather than L1 transfer.

In the following sub-sections, an introduction to CAH in 3.1.2 will be followed by an introduction to MDH in 3.1.3.

3.1.2 *The Contrastive Analysis Hypothesis (CAH)*

Lado’s (1957) original Contrastive Analysis Hypothesis (CAH) suggested that L2 learners access the TL through their native language and that the difficulties they encounter are due to L1-L2 differences. This version of CAH considered all 'non-native deviations' as due to 'interference' from the learner’s L1 and suggested the possibility of predicting production errors (i.e. that the CAH could predict where the difficulties in L2 acquisition would occur). The claim of the CAH was that errors that language learners make are attributed to transfer from the L1. Transfer not only occurs via alternation at a segmental level, but also refers to processes such as missyllabification or erroneous stress placement. Thus, when a learner depends on his/her native language to acquire L2 forms, it will be more difficult due to the absence of these forms in their L1, i.e. every difference equals a difficulty.

Although CAH initially focused on segments, it was applied to the syllable by Eckman (1977), who suggested that the degree of difficulty can be explained by applying the concept of typological markedness where the area of difficulty the language learner will have can be compared to the phonology of the L1, the TL and markedness relations. Tarone (1980, p.141) also applied universals and hypothesised transfer stating that “the learner would simply use the syllable structure from the first language in his/her attempt to communicate meaningfully in the target language” but importantly that “the second-language learner would tend to do what the first-language learner does with syllable structure”. Broselow (1984) concurs with Tarone’s Syllable Structure Transfer Hypothesis and states that where the TL has a syllable structure that is not permitted in the learner’s native language, the learner makes errors of ‘simplification’ by altering the non-permitted syllable structure of the TL to what is permitted in their native language. This hypothesis predicts that L2 learners will have difficulty in the pronunciation of the consonant clusters that are not permitted in their native language. In a previous study, Broselow (1983) found that syllabification resulting in epenthesis in Cairene and Iraqi Arabic speakers’ native varieties is transferred to the L2. She found that their L1 variety determined the position in which they insert the vowel [i] to break up consonant clusters, as in /flɔːr/ produced as [fi.lɔːr] by Cairene Arabic and [ʔif.lɔːr] by Iraqi Arabic learners. Broselow states that both pronunciations can be ascribed to the rule of epenthesis in the L1 variety which brings underlying syllable structures to conform to the restrictions on the syllable structures in the surface structure. Cairene uses ‘anaptyxis’, i.e. the insertion of a vowel to the right of the extrasyllabic consonant and resyllabifies it forming a CV syllable structure. On the other hand, Iraqi uses ‘prothesis’, i.e. the insertion of a vowel to the left of the extrasyllabic consonant thereby resyllabifying it and forming a VC syllable structure. A study that supports Broselow’s (1993) hypothesis was conducted by Alezetes (2007) on native Najdi Arabic (NA) speakers who were studying L2 English in America. Alezetes found that epenthesis was used by NA learners to break up words containing tri-consonantal clusters by producing children as [ʧil.də.ren], similar to the Cairene pronunciation in Broselow’s study.

Fleischhacker (2001) suggested that site of the prothetic/anaptyctic vowel in initial biconsonant clusters in loanwords and interlanguage phonology is triggered by the type of the consonant cluster. A prothetic vowel is inserted to put the members of the clusters into different syllables; i.e. voiceless sibilant + stop clusters (ST → VST), as in /ɪskul/ 'school' in Hindi and as in [**ʔi**skiː] 'ski' in Egyptian Arabic (Broselow, 1997, 1992, 1993). In biconsonant clusters containing obstruent+ sonorant clusters, an epenthetic vowel is inserted after the first member of the consonant cluster to split the cluster as in [pili:z] 'please' in Hindi (TR → TVR).

3.1.3 *The Markedness Differential Hypothesis (MDH)*

Two decades after the CAH was introduced, Eckman (1977) proposed the Markedness Differential Hypothesis (MDH) which, similar to CAH, takes into account L1 transfer. *Markedness* relation is determined by Eckman (1977) as follows:

> A phenomenon A in some languages is more marked than B if the presence of A in a language implies the presence of B, but the presence of B does not imply the presence of A. (Eckman, 1977, p.60).

In terms of typological markedness, cross-linguistically, unmarked forms are more frequent than their marked forms. For example, Belvins (1995) mentions that complex syllable margins (both onsets and codas) are more marked than simple onsets and codas. However, if a language has a marked form, it must have the unmarked form.

The MDH takes into consideration a form's degree of markedness in the NL vs. the TL before predicting the difficulty that L2 learners will encounter when learning the TL. It suggests that errors in second language acquisition result from universal factors and that the notion of *markedness* is universal rather than language-specific. That is, the CAH predicts the difficulty of L2 learning depending on L1-L2 differences, but the MDH suggests that while these differences are essential, they are not sufficient, and incorporating typological markedness into an explanation is needed.

According to the MDH, difficulty is expected to be faced by a learner not only if the target language differs from the native language but if the form in question is more marked than in a learner's L1. For example, if L1 does not permit complex syllable margins, learners are expected to have difficulty acquiring L2 forms.

If the target language differs from the native language and has less marked forms, however, learners are not expected to face difficulty. This means that L2 learners whose L1 permits complex syllable margins are not expected to face difficulty in acquiring an L2 that contains only simple syllable margins, since the learner is naturally using a more marked form in his/her L1 and moving to a less marked one in the TL. Thus, forms in the TL which do not exist or are different in the L1 will be simpler to acquire since they are unmarked.

Tarone (1980) proposed a ‘stronger’ version of MDH which predicts that markedness has more impact than difficulty. That is to say, markedness of areas of the TL could have a stronger impact than the difficulty in the L1. Thus, this version of MDH predicts that even native speakers whose native language permits complex syllable margins are predicted to face difficulties with the complex syllable margins of the TL, since these forms are marked. This option is not mentioned by CAH, since CAH predicts that learners should not have difficulty in the acquisition of the L2 forms that are also available in the L1.

The discussion above illustrates that when consonant clusters are not permitted in the learner’s L1, CAH predicts that the learner will face difficulty learning L2 forms. Similarly, MDH also predicts that if a learner’s L1 lacks consonant cluster, the learner will face difficulty in acquiring complex syllable structure, since complex syllable margins are more marked than simple syllables. In such an event, L2 learners resolve these complex structures by the use of different repair strategies available to them, as discussed below.

Studies in L2 phonology have provided evidence for learners’ difficulty in acquiring syllable structures as a result of the effect of sonority. For instance, Broselow and Finer (1991) investigated the effect of sonority in the production of L2 English clusters by 32 Japanese and Korean intermediate level speakers doing an intensive English program at the State University of Stony Brook. They examined their production of onset clusters of English pseudowords containing /Cr/ and /Cj/ comprising 32 sentences with the aim of eliciting their pronunciation of the clusters in phrase-initial positions. Their results revealed lower error rates in production of clusters with larger sonority distance (e.g. /pr/, stop – liquid) than those with smaller distance (e.g. /fr/, fricative – liquid). In other words, sonority distance played a role in their accurate production of the clusters

Berent et al. (2008) also provided evidence for English and Korean speakers’ accurate perception of non-native pseudowords with rising sonority of non-native onset clusters more than clusters with falling sonority. Similarly, another study among English speakers, Berent et al. (2009), found evidence for greater accuracy in rising sonority clusters in perception of initial nasal clusters by Russian speakers whose language permits these.

As discussed earlier, Tarone (1980) discussed the use of L2 syllable simplification strategies such as epenthesis and deletion resulting from syllable structure transfer and universals. Other research has also provided evidence of syllable structure repair strategies used by learners. This includes perception studies, e.g. of illusory vowels in response to difficult, non-L1 syllables, as seen in Mattews and Brown (2004) who investigated native Japanese and Thai speakers' ability to discriminate hetero-syllabic [k.t] vs [kVt] structures. Their results revealed that although the [kt] sequence is not permitted in either Thai or Japanese, Thai speakers were able to discriminate the sequences better than the Japanese speakers because in Thai, [k] is a possible syllable coda (i.e. if it is not followed by [t]), but never in Japanese).

In a study of Korean speakers, Kang (2003) stated that as for Korean speakers, even though voiceless stops are permitted in coda position in the L1, speakers often insert a vowel in the production of L2 English and in loanwords with voiceless coda after the coda (e.g. *tape* pronounced [t^heip^{h}ɨ]).

Metathesis has also been a strategy used by L2 learners, as discussed in Klove and Young-Scholten's (2001) investigation of adult L2 Polish and L2 Norwegian learners' syllable structure repair strategies, where they found that in addition to the other strategies mentioned, learners also used metathesis (the reordering of sequences in a word that are not present in the L1) as a repair strategy to resolve difficult non-L1 syllables.

In sum, this section has reviewed various theoretical perspectives and research in L2 phonological acquisition which revolve around L1 transfer and universals such as markedness as L2 learners attempt to repair L2 syllables more difficult than those in the L1. In the following section, a review of another influence on interlanguage phonology with respect to syllables will be discussed, that of orthographic input.

3.2 **Orthographic Input (OI)**

This section introduces the idea of orthographic input and its possible influence on IL phonology. Then, previous studies on its positive effects will be presented in 3.2.2 followed by negative effects in 3.2.3. Since this research focuses on literacy as a variable, section 3.3 presents the effect of L1 literacy on L2 acquisition.

3.2.1 *Introduction to Orthographic Input (OI)*

Second language learners, if in a classroom, are usually heavily exposed initially to the orthographic input (OI) ‘written forms’ or ‘spellings’ of the TL, while young children learning their first language are initially exposed to phonological aural input (AI), i.e. auditory input during acquisition of their native language. The distinction between the exposure of aural input in L1 and its influence on the acquisition of phonology and the exposure of orthographic input in L2 and its impact on L2 phonology has been of interest to L2 phonologists from the time when the first pioneering study was published in the late 1990s by Young-Scholten et al. (1999). The standard assumption suggests that competence in the child’s first language results from the interaction between input or ‘primary linguistic data’ in the child’s environment with innate linguistic mechanism (Universal Grammar UG) (Young-Scholten et al., 1999). According to Young-Scholten et al. (1999), post-puberty L2 learners, similarly to first language learners, retain access to UG. Following Krashen (1985) and Schwartz (1993), Young-Scholten et al. (1999) further assume that exposure to written forms, that is ‘form-focus’, with absence of the application of linguistic mechanisms could lead to something else, i.e. learned linguistic knowledge. According to Young-Scholten et al. (1999), a wide variety of ways in which form can be focused on in phonology includes prompting a learner to attend to particular acoustic patterns. In their first study, the preliminary focus was on the graphemic representations or ‘written forms’ of phonological forms, which is known as ‘orthography’.

Sato (1984) claimed that L2 learners do not at all times simplify L2 syllable structure like children do, mainly in the use of epenthesis, since, according to Sato, there are age-related factors in operation. This is illustrated by Riney (1990), who conducted a cross-sectional study; i.e. Vietnamese learners of English were from different age groups. They were aged between 10 and 55 and had all lived at least one year in the USA, having started L2 learning when they immigrated to the USA. With respect to syllable simplification, Riney found that the younger the L2 learner, the less they epenthesised and the more they deleted, while the older the learner, the more they epenthesised and the less they deleted. Young-Scholten et al. (1999) focused on this observation and considered several possible explanations. One explanation is that L2 learners are not using the same mechanisms as children. For example, young children rarely epenthesise since recoverability matures only after mastering the first language syllable structure (Weinberger, 1988, 1993). When adults are acquiring an L2, recoverability is already mature. Another possible explanation is related to the immaturity of a child's short-term memory, as proposed by Newport (1990) who suggested that young children tend to delete structure more than overgeneralise forms and this would apply to their lower use of epenthesis. Young-Scholten et al.'s (1999) final proposal is that orthographic input, as a type of 'focus on form', promotes epenthesis since a given segment's written form will be noticed by L2 learners during the formation of lexical representations.

Nowadays, this area of research has a sizable number of published works, having started to appear from the first decade of the 21st century (e.g. Young-Scholten (2002), Bassetti (2007, 2009), Escudero et al. (2008), Silveira (2009), Simon et al. (2010), Rafat (2011, 2015), Bassetti et al. (2015), and Young-Scholten and Langer (2015)).

Bassetti et al. (2015) mention that orthographic influence on L2 phonology can no longer be ignored, for many reasons. According to them, an apparent reason is the considerate amount of empirical evidence that has been accumulated by a group of interested researchers, whereby there were important contributions that emphasised the effect of orthography on the phonology of second language learners. Furthermore, the effects of orthography on L2 phonology is a universal and widespread phenomenon, not only because these effects influence the majority of L2 learners but also because all aspects of L2 phonology, such as production, perception and acquisition of L2 sounds and words, are affected. Another reason is the implications that can be taken into account for L2 learning and teaching in which OI should be treated as an important factor in L2 phonological acquisition (Bassetti et al., 2015).

The exposure of L2 learners to orthographic representations is, nonetheless, debated among L2 phonologists; some claim its importance in enhancing L2 learning, while others see it as having the negative impact of hindering target-like acquisition. A third group of researchers find that its negative and positive effects are equal. An example of the third group, Escudero and Wanrooij (2010), found evidence of the hindering as well as facilitating effects of orthographic input when they conducted several experiments on 204 adult Spanish-speaking learners of Dutch living in the Netherlands whose age of arrival was after 15 years of age. Their mean age at testing was 30.00 for beginners and 37.52 for advanced learners. The participants' perceptions covered the levels of learning proficiency from naive listeners and beginners to advanced learners. The focus of their study was on the phonemic vowel perception in the absence of lexical contexts in order to study whether orthography triggers phonology sublexically. The tested Dutch contrasts were /y–ʏ/,/i–ɪ/,/a–ɑ/,/ɪ–ʏ/ and /i–ʏ/ and the participants' task was to perform an auditory-orthographic categorization formatted as XAB format and the five Dutch contrasts (/a../, /i../, /y../, /i.y/, and /.../ were targeted. The participants were asked to decide if the first sound (X) was the same as the second (A) or the third (B). From the results, the authors drew conclusions about which orthographic input facilitated the most difficult contrast in the auditory task.

The positive effects of L2 orthographic input in L2 phonology will be discussed in 3.2.2 and the negative impact will follow in 3.2.3.

3.2.2 ***Positive Effects of Orthography on L2 Phonological Acquisition***

A number of L2 phonologists have proposed the importance of the availability of orthographic representations to support L2 learners' speech production, perception and/or word form learning (e.g. Escudero et al. (2008), Escudero and Wanrooij (2010), Showalter and Hayes-Harb (2013), Rafat (2015), and Escurdero (2015)). For example, Escudero et al.'s (2008) study of 50 Dutch participants with a mean age of 21.1 years divided into two groups was conducted to explore whether the accessibility of spelled forms of nonwords would affect the learners' lexical representation of the phonological content. They were exposed to OI consisting of L2 confusable nonwords containing English contrasts /ɛ/ and /æ/ (e.g. [tɛnzə], [tændək]) during the learning of novel English words. The English vowel inventory consists of both /ɛ/ and /æ/ while Dutch vowel inventory contains /ɛ/ but not /æ/. One group were taught the words by matching auditory forms to visualized meanings while the other group saw the written forms of the words (e.g. 'tandek' and 'tenzer') which meant that the orthographic letters <e> and <a> provided visual cues for the /ɛ/ and /æ/ contrast. The first group who were exposed to orthographic forms looked at the target only when the words contained /ɛ/, whereas participants who were exposed to the auditory input during learning mixed syllables containing English /ɛ/ and æ/ with one another. However, the researchers explained that the vowels in the English words 'pen' /pɛn/ and 'panda' /pændə/ are spelled with letters that differentiate two native Dutch vowels (/ɑ/ and /ɛ/) and it seems that Dutch learners use their Dutch phoneme-to-grapheme correspondence in their English lexicon acquisition to differentiate English (/ɛ/ and /æ/) vowels in word-recognition tasks where lexical knowledge is involved. Thus, the accessibility of orthography led to a discontinuity between lexical and perceptual performance, which facilitated Dutch learners' lexical contrasts where they could not discriminate these in perception tasks. The authors proposed that accessing different orthographic representations can facilitate the perception of L2 learners in a way that they can differentiate lexical representations for minimal pairs having contrast, which can result in more L2 development.

Escudero et al.'s (2008) findings are echoed by recent studies (e.g. Simon et al. (2010), and Young-Scholten and Langer (2015)). For example, Simon et al. (2010) examined whether exposure to orthography would aid the ability of L2 learners to acquire a novel phonological contrast. They investigated two French vowel contrasts, /u/–/y/, which are difficult for English speakers who do not have the high front vowel in their vowel inventory system. Twenty native American English-speaking participants studying at the University of North Texas were recruited and participated in the orthographic and auditory information study. They were shown pictures (such as *glasses*, *a boat* and *a banana*) and heard the auditory forms (e.g. [stig] - [styg] - [stug]) when they saw the corresponding orthographic representations (<stigue> - <stûgue>- <stougue>). The findings showed that orthographic availability did not significantly aid participants compared to those in the auditory only group.

Similarly, Showalter and Hayes-Harb (2013) examined whether novel written information, diacritic tone marks, can affect L2 learners' memory of the phonological forms of newly acquired L2 words. Thirty native English-speaking participants aged 18–35 doing undergraduate courses at the University of Utah were recruited and participated in the study. One group of participants were taught by hearing auditory forms and seeing segment sequences in which the diacritic tone marks of the four-tone contrast in Mandarin were shown (e.g. <fián>). The second group were exposed to the orthographic information without tone diacritics (e.g., <fian>). They were tested to see whether they had made lexical representations between the lexical form and pictures. It was found that learners' performance in the tone marks condition was more accurate. The researchers suggested that the availability of the diacritics had aided each learner's memory for the phonological forms of the newly acquired words; learners made use of novel orthographic information.

Rafat (2015) looked at the acoustic properties of the auditory input by teaching naive native English-speaking adults a set of Spanish words containing word-final assibilated / rhotic [ř]. A group of the participants were exposed to orthographic input during learning (with the written form of /r/) while the other group were not. Participants were asked to produce the words. Rafat found that those who were not exposed to the orthographic input produced the word final rhotic as fricative ([h, ʃ, s]) while the other group who were exposed to the written form produced the word-final as rhotic both target-like [ř] but also English [ɹ]. This research supports the view of the positive effect of exposing L2 learners to orthographic input, since the participants who had access to the written form of the words noticed the rhoticity of the final segment. Rafat (2015) mentions that participants produced the approximant rhotic due to the overriding effect of orthography, since both the L1 and L2 in this study share rhotics. Featural similarity between native language and target language, according to Rafat (2013), induces L1-based phonological transfer, where the findings of her study showed that if L1 and L2 have shared graphemes (in this case <r>), the more the L1 sounds are similar to the target language, the greater the possibility of L1 phonological transfer.

Other studies have shown positive effects of OI; for instance, Hayes-Harb et al. (2018) found a significant effect of OI by the spelling group in their experiment suggesting that their memory for the phonological forms of newly learned words was influenced by the written form. Their study was conducted among 26 native speakers of English aged 18–31, randomly assigned to two word learning conditions made up of the 'Spell' group and the 'No Spell' group. The participants in the 'Spell' group saw the written forms of the words immediately after hearing the auditory tokens of each word. The words were 12 German-like words made up of pairs contrasting in the underlying voicing of the word final stop.

In sum, previous studies mentioned in this section suggest that availability of written form can facilitate L2 acquisition when learners are exposed to confusable contrasts in their L2.

3.2.3 *Negative Effects of Orthography on L2 Phonological Acquisition*

The issue of how OI hinders target-like acquisition is also supported by L2 phonologists (e.g. Young-Scholten et al. (1999), Bassetti (2007, 2009), Escudero and Wanrooij (2010), Bassetti and Atkinson (2015), Young-Scholten and Langer (2015), and Mathieu (2016)) where other researchers did not find exposure to OI a useful strategy for L2 learners (e.g. Escudero (2015), and Showalter and Hayes-Harb (2015)). For example, Young-Scholten et al. (1999) tested the claim that most post-puberty L2 learners prefer to epenthesise rather than to delete when exposed to orthographic input because they want to retain the consonant clusters they see in it. This also agrees with Weinberger's concept of recoverability mentioned earlier. They found that native English speakers and native Japanese speakers who were presented with a set of Polish words with consonant clusters more complex in English and much more complex than in Japanese added epenthetic vowels more often when they were exposed to the written form of the words. Young-Scholten (2002) suggested that the higher rates of epenthesis compared with the lower rates of deletion are due to the memory-enhancing effect of orthographic exposure during learning and during testing.

In a study of the acquisition of the final devoicing rule in German, Young-Scholten (2000) suggests that the rate of transfer in the acquisition is shaped by the amount of exposure to the TL and to written text in the language. In German, obstruents, when occurring in the syllable-final position, are devoiced in such examples as <Bund>, which represents /bʊnd/ but is realised as [bʊnt]. Young-Scholten recruited three American-speaking exchange students aged between 15 and 17 to carry out an 11-month longitudinal study. Data were collected every month by asking participants to pronounce the German words for singular and plural forms or comparative forms of adjectives and nouns written in participants' native language on cards. Participants were also required to give a rating of the amount of exposure to aural and to written input they had. It was found that exposure to orthography hindered the acquisition of the final devoicing rule in German, where learners erroneously produced /bʊnd/ -> [bʊnt] based on its spelling as <bund> as *[bʊnd].

Similarly, Bassetti (2007) found that a learner's L1 spelling conventions can negatively affect the acquisition of phonological forms in the TL. The study was conducted on native English speakers learning Mandarin using a Roman alphabet representation of the language, i.e. L1-based grapheme-phoneme correspondences. Participants were asked to count and segment diphthongs and triphthongs in a Mandarin listening task, as in <wei>–[uei]. The results showed that because of OI they counted and segmented fewer than what was presented. Bassetti (2007) saw these findings to be the result of inferences that learners made about the phonological forms of the utterances depending on how the words are spelled in Pinyin. In addition, Bassetti (2009) argued that orthographic input may lead to some non-native results, such as phoneme addition, omission and substitution, which would be avoided if learners were exposed only to phonological input.

Young-Scholten et al. (1999) and Bassetti (2009) both confirm that if L2 learners are exposed only to phonological input, deletion will be used to simplify consonant clusters not permitted in their L1. It has been assumed that learners will commit errors that children commit when acquiring their L1, since native-speaking children delete consonant clusters but rarely epenthesise (Young-Scholten et al., 1999).

Bassetti and Atkinson (2015) investigated orthographic influence among fourteen Italian speakers learning eight familiar English words that contained a silent letter (<b>, <d>, or <l>).

By exposing learners to different tasks and input - acoustic input, no input or orthographic input - the authors analysed the results using auditory and acoustic analysis. The results showed that silent letters caused consonant additions, vowels were lengthened when they spelled a vowel digraph compared to vowels spelled using a singleton letter, and the orthography of <ed>, the past tense marker, resulted in voicing and vowel addition. The effects of orthography in L2 learning were obvious in all tasks, even if it was more noticeable in reading than in a repetition task. Bassetti and Atkinson's (2015) study supports the findings of Young-Scholten et al. (1999) and Bassetti (2009).

On the other hand, in one of the original longitudinal unstructured studies, Young-Scholten and Langer (2015) examined the role of orthographic forms on L2 German phonemes /z/ <s> and /ts/ <z> acquisition over a one-year period. In their study, three young adolescent native English speakers who were spending a year in Germany but had no prior exposure to German beforehand were exposed to both orthographic and phonological input. Since their study was naturalistic, i.e. the learners did not receive instruction in L2 German, participants were exposed to more auditory than orthographic input. During the research period, monthly data collection sessions were conducted by the researchers and the authors selected four of these from different points of the year and then analysed the target German phonemes using IPA transcription along with acoustic analysis using Praat. They argued that OI influenced their participants' L2 learning because the participants exhibited problems in producing [z] when it was represented by <s>, despite there being no relevant L1 English constraints on [z]. That is, their mis-productions were the result of grapheme-phoneme correspondences in the orthography of their L1.

Regardless of linguistic background and the type of writing system of the learner's L1, availability of OI does not seem to aid learners, as found by Escudero (2015) in her study of Spanish (transparent orthography) and English (opaque) speakers learning novel Dutch words among 151 undergraduate students at an Australian University. They consisted of 78 Australian English speakers and 73 Iberian or Latin American Spanish speakers. Their ages were between 18–35 years. The participants were given 51 non-minimal pairs and 15 minimal pairs. Out of this number, the orthographic information helped learners to discriminate only two non-native contrasts which were comparatively easy to be discriminated, e.g. 'pag' – 'pieg'. The findings show that OI neither helped L2 learners to learn Dutch words that differed with the L1 in most of their phonemes (non-minimal pair) nor did it help in learning Dutch words that differed only in a single phoneme (minimal pairs in the L2), which learners can discriminate in their native languages (e.g. /i/–/a/). Escudero (2015) recommended that the negative effects of OI may outnumber its positive effects. She suggested that avoiding exposure to OI may be a good strategy not only for L2 learners but that L2 teachers should take note if the aim is to achieve native-like competence in the L2.

Up until now, most of the studies which have investigated the influence of OI on the acquisition of L2 phonology have involved languages that use Roman-alphabet-based orthographies. The influence of written representations in other scripts, such as Perso-Arabic, on the L2 acquisition of phonology is still understudied (Mathieu, 2016). Regarding the influence of L1 Arabic written representations on L2 acquisition, Showalter and Hayes-Harb (2015) investigated the influence of novel orthographic input on L2 phonological acquisition of Arabic. In their study, native English speakers were taught twelve Arabic non-words. Participants were exposed to four different learning experiments. Experiments had unified target words which were either $C_1V_1C_2V_1$ as in [kini] or $C_1V_1C_2V_2$ as in [kita]. The created words were differentiated by the velar-uvular contrast in the initial position, as in [kini] vs. [qini] and [kubu] vs. [qubu]. In the first experiment, 30 native English speakers were recruited and divided randomly into two groups: 'Arabic script' and 'control'. Arabic script participants were exposed to the written Arabic form encoded by the velar-uvular contrast by distinct graphemes (<كـ> /k/ and <ق > /q/). This means that they were exposed to the Arabic script, such as (<قيتا> for [qita]), where the control condition was exposed to a string of four meaningless Arabic graphemes, such as (ط ط ط ط). In the second experiment, eight participants were instructed to learn the non-words given in the first experiment. That is to say, participants were given instructions about the writing system of the Arabic language since participants in experiment one, according to Showalter and Hayes-Harb (2015), did not know that Arabic is written from right to left and did not notice that the right edges of the words consisted of the novel phonological contrast. In the third experiment, eight participants were taught the target Arabic non-words by exposing learners to the English script, i.e. listen to the word [kubu], see the orthographic input in English orthography, and see a picture of glasses. Even when manipulating orthographic input in various ways, researchers found that learners did not benefit from exposure to orthographic input during word learning.

The results of Showalter and Hayes Harb (2015) study differ from those of Showalter and Hayes-Harb (2013) as they checked whether adult native English speakers with no knowledge of Mandarin would use tone marks in assisting them to associate lexical tone with new L2 Mandarin words. The participants were divided into two-word learning groups comprising 26 participants aged 18-30 in the 'tone marks' group and 28 participants aged 18-30 (except one participant who was aged 18-40) in the 'no tone marks' group. They were asked to relate Mandarin nonwords differing in lexical tones with written forms during the word learning phase. The first experiment required participants to associate, for example, a picture with tone 1 and whether it matched an auditory form containing tone 2. The results revealed that the 'tone marks' group outperformed the 'no tone marks' group, which suggests that the availability of unfamiliar orthography helped them in associating lexical tone with new words. The second experiment tested matching of spelled forms and auditory forms. Likewise, the result of the second experiment revealed the 'tone marks' group outperformed the 'no tone marks' group, suggesting that the 'tone marks' group learned to some extent the correspondence between auditory tones and marks. This suggests that availability of an unfamiliar script could facilitate L2 acquisition.

Similarly, Mathieu (2016) studied the influence of three different scripts on L2 Arabic consonantal contrast in order to investigate in detail the effects of different graphical elements on the availability of participants to adequately establish novel phonological representations. In the study, 84 monolingual English native speakers who had no prior knowledge of Arabic were instructed to learn six pairs of minimal contrast. The study focused on the acquisition of the uvular /χ/ fricatives and voiceless pharyngeal /ħ/ word-initially in Arabic as in (/χal/–/ħal/). Participants were divided into four groups: the first group (no orthography) were exposed to aural input only, the second group (Arabic script) were exposed to the Arabic script, the third group (Cyrillic script) were exposed to the Cyrillic script to discover the possible influence of a foreign script on the acquisition of the same L2 contrast, while the fourth group (Hybrid script) were exposed to the Roman/Cyrillic script in order to address a particular confound that could arise as a result of using the Cyrillic script. The material included CVC Arabic and comprised both words and non-words, contrasted in the onset position. The study replicated the methods used by Showalter (2012), and Showalter and Hayes-Harb (2015). The experiment was divided into three stages: word-learning phase, criterion test phase, and phonological test phase. Participants of script conditions saw the words written under the picture of every word while the 'No orthography' condition saw a string of three Xs, as shown in Figure 3-1 below.

Picture	Auditory form	No orthography	Arabic script	Cyrillic script	Hybrid script
	[ħal]	XXX / ◆◆◆	حال	haл	ҵal
	[χal]	XXX / ≺≺≺	خال	xaл	жal
	[ħif]	XXX / ✚✚✚	حيف	hiф	ҵif
	[χif]	XXX / ●●●	خيف	xiф	жif

Figure 3-1: Visual and written stimuli for each L2 word-learning conditions (Mathieu, 2016)

In the criterion test phase, participants were given a computer-mediated test to measure their ability to memorise the pictured objects and their auditory label. In this stage, pictures were shown without orthographic representations and participants were asked to indicate whether the accompanying auditory stimuli matched or did not match the picture by pressing YES/NO labelled keys. In the phonological test phase, participants' knowledge of learned minimal pairs was tested by presenting them with a picture and they were asked to make a YES/NO matching decision. The written form of the words was not available at this stage either. Hence, participants had to rely on their phonological (and possibly orthographic) memory of the words they had learned. The nature of the (mis)match here, as Mathieu mentions, was to investigate the non-native contrast of the phonemes studied: /ħ/–/χ/. Hence, all picture-word pairs were displayed twice in a total of 24 presentations; one matched correctly and one mismatched. Mathieu found that there were no significant differences among the script conditions. In other words, unfamiliarity or degree of script foreignness had little impact on the acquisition of non-native phonological contrast. Yet, when comparing 'No orthography' condition with the Arabic script condition, Mathieu compared the result of 'No orthography' condition to the other three script conditions, i.e. Arabic script, Cyrillic script and Hybrid script. The findings show that those who were exposed to the Arabic script achieved significantly less when trying to distinguish the phonological representations than those who were exposed to only aural input (those who were provided with three Xs). By contrast, those who were exposed to the Cyrillic script did not obtain any advantage from the script and performed similar to those who were exposed to no orthography. When comparing participants of the hybrid script condition to those of 'No orthography', participants of the hybrid script condition performed lower than participants of the 'No orthography' condition. Mathieu concludes that exposure to unfamiliar written input, such as Arabic script, hinders the formation of target-like phonological representations, especially in the early stages of L2 acquisition.

Showalter (2018) conducted a study among 30 native English-speaking students in the USA aged 18–43 with no prior formal experience with the Cyrillic alphabet. Participants were divided into 2 groups: a ‘No Orthography’ group and an ‘Orthography’ group. The study was conducted to find how “grapheme familiarity and congruence interact in the context of native English speakers learning Russian Cyrillic words” (p.586). Showalter found that incongruent written forms interfered with participants’ ability to make inferences about the phonological forms of words. This signifies the negative effect of incongruent OI in learning the phonological forms of L2 words. The phonological forms of words were not remembered by participants due to the interference of OI even when difficult-to-perceive contrasts were absent. The findings agreed with Bassetti’s (2006) study in which children negatively transferred the conventions of English orthography during phoneme contrast and segmentation tasks in Mandarin. Also, Simon et al.’s (2010) study found that OI did not affect participants’ inferential ability in acquiring the phonological forms of French words.

Rafat and Stevenson’s (2018) recent study of 45 native Canadian English speakers examined whether exposure to auditory input and OI is affected by the McGurk-like effect, “a synchronous and simultaneous presentation of incongruent auditory and visual/facial cues” (p.2). Participants took part in a picture-naming task in an artificial language consisting of Spanish phonology and orthography in order to test the effect of condition of training and production coupled with the effect of grapheme-to-sound correspondences and the positions of L1-based phonological transfer. The results showed that exposure to auditory and OI may lead to a McGurk-like effect resulting in combination productions in L2 speech learning at the onset of acquisition along with transfer.

To sum up, reviewing the literature related to the effects of orthography input on L2 phonology shows that few researchers have found it to be effective in the acquisition of segmental phonology. By contrast, its negative impact on the learning process has been agreed upon by the majority of interested researchers.

None of these researchers, or researchers in any other study, have investigated the role of L1 literacy in the acquisition of L2 phonology. Before the author turns to this, the following subsection will briefly review what is known about the general influence of L1 literacy in L2 acquisition.

3.3 Effects of Learners' First Language Literacy on Second Language Acquisition

The impact of a learner's first language literacy on second language acquisition has been of interest to some L2 researchers for several decades now. For example, Huntley (1992) conducted a study looking at the pedagogical principles applied during the teaching of English as a second language to non-literate adults. In the study, four types of literacy were observed: preliterate, non-literate, semiliterate, and Roman alphabet-literate. According to Huntley's division, preliterate are the learners who originally come from a culture that does not have a written form for their language or the language has only recently been written. They have no prior knowledge with written texts. It has been observed that their L2 literacy develops more slowly than their oral language. The second type is non-literate learners, who differ from literate learners in that literacy is available in their culture but they did not get the chance to receive literacy instruction; many of the participants in Huntley's study could barely write their names. Semiliterates are defined as those who have had interrupted literacy instruction. They were classified as developing slowly. Finally, non-alphabetic literate L2 learners are those who use a language that is not written using the Roman alphabet. In studying the role of L1 literacy, Burt et al. (2003) mentions these literacy classifications of Huntley (1992).

It appears that the level of a learner's L1 literacy plays an essential role in L2 acquisition. Faltis and Coulter (2008) confirm that adult English learners who have prior academic and literacy experience in their L1 have the ability to acquire the TL more quickly than those who have little education or have never been to school. Alderson (2005) also notes that L2 readers with satisfactory reading skills from their L1 differ significantly from those who have not been exposed to formal education in their L1.

Bigelow and Tarone (2004) argue that studies provide evidence for a relationship between L1 and L2 literacy, suggesting that L1 literacy helps learners becoming literate in the L2 (e.g. Bialystok (2002) and Cummins (1991)). They note that it took longer (7 to 10 years) for L2 learners who were not literate in their L1 to learn "L2 literacy-related, context-reduced, and cognitively demanding academic language skills" (p. 690), and that some never seemed to catch up with their native speaking peers. On the other hand, it took less time for those who had L1 literacy skills to acquire comparable literacy skills in the L2. With respect to linguistic competence, Bigelow and Tarone propose that literacy also affects L2 processing in that less literate learners are less capable of noticing the difference between linguistic forms in oral input. They make reference to Schmidt's (1990) Noticing Hypothesis which states that "for learners to acquire a linguistic form in an L2, they must consciously notice it" (p.693). Bigelow and Tarone further state that the multiple contexts in which L2 learning occurs and the multiple characteristics that learners bring to L2 learning need to be recognised by SLA researchers. This should include studying L2 learners who are not literate in their L1 in order to fully understand important variables affecting the SLA processes.

To date, researchers who are interested in L2 phonological acquisition have directed their investigations to the production of L2 learners without considering L1 literacy as a variable; i.e. L2 phonologists typically study participants with literacy levels in their native language that are normal for their age. From the literature reviewed above, and based on the author's knowledge, the link between L1 literacy level and acquiring new phonological form has not been reported in literature. This is despite the fact that L1 literacy skills influence the development of literacy skills in an L2. The current study therefore includes the hypothesis that literacy in L1 leads to spelling-influenced non-native pronunciation along with the hypothesis that lack of literacy does not. That in turn leads to a research question: to what extent is the non-native pronunciation of non-literates similar to not-yet-literate young children's non-adult pronunciation? When it comes to epenthesis, we could hypothesise that L1 non-literates will prefer the same strategy that young children use, that is, deletion/omission rather than epenthesis as a strategy to simplify consonant clusters (Weinberger, 1987; Young-Scholten et al., 1999). Hence, the following section presents the phonological error patterns that young children use at early stages of the L1 acquisition of English.

3.4 **Phonological Error Patterns by Children**

In the early stages of life, young children acquire their native languages depending purely on the aural phonological input. They make errors (produce non-adult forms) in their production of their native language. Processes leading to the errors are termed by interested scholars as 'error patterns' or 'phonological processes' which describe a child's phonological system. The term 'phonological processes' originated in Stampe (1969) and was then adopted by researchers interested in studying child phonology, such as Ingram (1976). Phonological processes are defined as the mental operations that lead to the modification or omission of phonological elements and the idea is that this is because human perception and vocal production are naturally limited. The topic of children's error patterns when acquiring L1 and L2 has been visited by many interested scholars and many studies have been carried out regarding this. As this study is mainly focused on the phonological acquisition of consonant clusters by adult learners and since only one type of learner, ‘non-literate learners’, will be compared to the acquisition of young learners, this field of research is only briefly discussed in the current study.

Children’s error patterns have been categorised with respect to levels. Dodd et al. (2006) mention that English-speaking children’s speech errors can be classified into two levels. Error patterns of the first level are in turn classified into two groups. The first sub-category is substitution error patterns in which a sound is substituted for another sound. The second sub-category of the first level of error patterns are syllable error pattern in which the syllabic structure of the word/s is affected or changed (Bankson and Bernthal, 1998). Error patterns of the second level are categorised into many sub-divisions for syllable error patterns and for many others for substitution error patterns. Starting with syllable error patterns, Dodd et al. (2006) include epenthesis, weak syllable deletion, metathesis, final consonant deletion, assimilation, reduplication, consonant cluster reduction, coalescence, and substitution which is further categorised into voicing, vocalising, and velar deviation.

Preisser et al. (1988) looked at the utterances of 60 typically developing children aged between two and six years old. The commonly used error patterns were liquid deviation, velar deviation, and cluster reduction. Similarly, Roberts et al. (1990) conducted a study involving 145 children aged between two and eight years. They noted that error patterns of liquid gliding, stopping, fronting, deaffrication, and consonant deletion were found in the speech of children aged four years or less, i.e. there was a noticeable decline in process use by children aged four or less. Then, after the age of four, error patterns such as liquid gliding, deaffrication, and cluster reduction were dominant.

Since the learners in the present study are native Najdi Arabic speakers, it is also useful to look at young children learning Arabic. Ammar (1992) investigated the error patterns in the speech of 32 Egyptian-Arabic speaking children. Half of them were typically developing and were aged between 48 and 58 months. The other 16 children were phonologically disordered and aged between four and nine years of age. According to Ammar’s phonological process analysis, voicing was the dominant error pattern that the typically developing Egyptian children used. The phonologically disordered children significantly differed from those who were typically developing in terms of phoneme errors but they had the same percentage of order of acquisition. According to Ammar, typically developing Arabic-speaking children’s speech error patterns fell into seven types: sibilant fronting; /r/ deviation where it may be substituted by /l/, a glide or a vowel; devoicing; de-emphasisation; di- and polysyllabic word simplification; velar fronting and cluster simplification (where the percentages were very low, at 25%). Phonologically disordered children, in comparison, not only had higher percentages of speech errors but, in addition to the error patterns used by typically developing children, they also used three more error patterns: glottal replacement, assimilation, and final consonant deletion. Khattab (2002) added that young Arabic speakers modify Arabic /r/ using strategies such as /r/ omission in such example as /na:ɾ/ → [na:] 'fire'; assimilation as in /ʔiɾkab/ → [ʔikkab] 'I ride'; and lateralisation as in /ɾasam/ [lasam]. She mentioned that /r/ could be substituted to [w] since these two sounds involve labiality similarly to what Leopold (1970) noted when he studied his English-German daughter's /r/ production. Leopold summarised that his daughter constantly substituted /r/ with [w].

In another study, Ammar (1999) studied the acquisition of consonant clusters in 51 typically developing Egyptian Arabic-speaking children. Target words were 100 monosyllabic words with CVCC syllable structure.[6] Most of the words were familiar to the children of that age. Ammar applied both qualitative and quantitative analysis. The quantitative approach was used to analyse correct responses while the qualitative approach was used to describe observed different error patterns. In Ammar's study, the qualitative analysis showed that participants used a variety of error patterns. These error patterns included omission of the whole cluster in a word such as /daʔn/ → [da] 'chin'; omission of one member of the consonant cluster /ʔird/ → [ʔir] 'monkey'; and omission of one member of the consonant cluster and vowel lengthening as in /kalb/ → [ka:b] 'dog'. The results showed that although children deleted the second member of the consonant cluster more than the first one, the manner of articulation affected the results. According to Ammar, if the first consonant in CC is a lateral or trill, and the second consonant is a fricative, the former was liable to be omitted.

The sections above have reviewed research findings on interlanguage phonology, starting with Lado's Contrastive Analysis Hypothesis (CAH) and moving on to Eckman's Markedness Differential Hypothesis (MDH), which then led to a review of the L2 syllable simplification strategy used by learners to simplify difficult L2 syllable structures. A look at the effects of

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[6]Egyptian Arabic, according to Ammar and Morsi (2006), has five types of syllables; two short syllable forms (CV and CVC) and three long syllable forms (CVCC, CVV and CVVC). All these types of syllables can form a monosyllabic word. Words in Egyptian Arabic do not permit more than one heavy syllable, nor does it allow clustering of stops and fricatives such as */bf/ and */fb/.

orthographic input also revealed that there could be positive as well as negative effects in L2 phonological acquisition. The literature related to the role of L1 literacy in the acquisition of L2 showed that the more the learner is experienced in his/her L1, the more quickly L2 is acquired (Faltis and Coulter, 2008). In addition, by looking at early phonological errors made by children in L1 acquisition, it was found that some adult L2 learner's errors could be the same as or similar to children's error patterns. However, most of the studies on L1 acquisition suggest that young L1 learners prefer deletion over epenthesis.

3.5 **Chapter Summary**

Effects of native languages on the acquisition of newly learned languages, and exposure to the orthographic input and variables that could affect L2 acquisition were presented in this chapter. This chapter has shown that interlanguage phonology has long been the interest of many scholars, resulting in the CAH (Lado, 1957) and the MDH (Eckman, 1977). Since the L1 involved in the present study, Najdi Arabic, permits two-consonant clusters on word edges (onset and coda), the CAH would predict that Najdi Arabic learners of L2 English will have less difficulty in the production of English biconsonantal clusters due to the similarity of the syllable structure of the two languages. Yet, when the syllable structure becomes more complex, as in the case of three consonant clusters, the CAH would predict that Najdi Arabic speakers will have difficulty in the production of tri-consonant clusters since this structure does not exist in their L1 and they will therefore modify the syllable structure; i.e. every difference will equal difficulty. Similarly, the MDH would also predict that Najdi Arabic speakers would have less difficulty in the production of two-consonant clusters in their L2 acquisition due to the two-consonant clusters being less marked than three-consonant clusters. Nevertheless, the stronger version of MDH by Tarone (1980) predicts that Najdi Arabic-speaking L2 English learners would have difficulties in the production of complex syllables regardless of whether these structures exist in the learner's L1 or not, since these are marked. However, in three-consonant clusters, MDH considers it a more marked syllable structure and learners would have difficulty. That is to say, the difficulty of L2 learning is predicted by the CAH depending on the differences between L1 and TL, while the MDH suggests that differences of L1 and TL are important for such explanation but are not sufficient.

This chapter has also discussed orthographic input as an important variable in L2 acquisition. Since the late 1990s, OI has become an area of research in L2 phonology since the first pioneering study was published by Young-Scholten et al. (1999). From that time, researchers (such as Young-Scholten et al. (1999), Bassetti (2007, 2009), Bassetti and Atkinson (2015), Young-Scholten and Langer (2015), Showalter (2018), and Rafat and Stevenson (2018)) have provided evidence that exposure only to aural phonological input leads to deletion being preferred to simplify consonant clusters not permitted in the L1, and that exposure to orthographic input leads to epenthesis being a preferable strategy. By contrast, many other L2 phonologists (such as Escudero et al. (2008), Showalter and Hayes-Harb (2013), Rafat (2015), Escurdero (2015), and Hayes-Harb et al. (2018)) have found that the availability of written forms can aid learners in their L2 perception and production.

This chapter has also discussed what is known about the effects of a learner's first language literacy on the acquisition of new languages.

In addition to overviewing the role of L1 in the acquisition of L2 as well as reviewing the role of OI, an overview of young children's phonological error patterns has been provided. Error patterns were classified into two main categories: substitution error patterns and syllable error patterns (Bankson and Bernthal, 1998). Studies carried out by Dodd et al. (2006), Preisser et al. (1988), and Ammar (1992, 1999) were also reviewed in the context of normal developing children and phonologically disordered children. Here, it was seen that both types of children rely commonly on substitution and consonant reduction. Phonologically disordered children, in Ammar's (1992) study, had higher percentages of errors than those who were developing normally. Ammar mentions that final consonant deletion is a strategy used by phonologically atypically developing children as well as typically developing children. Findings of a later study by Ammar (1999) indicated that deletion is a strategy used by normally developing children where they would possibly delete the whole cluster in a word such as /daʔn/ → [da] 'chin', delete the final member of the consonant cluster as in /ʔird/ → [ʔir] 'monkey', or delete a member of the consonant cluster and lengthen a vowel as in /kalb/ → [ka:b] 'dog'.

Following Young-Scholten et al. (1999), 'focus on form' is introduced and hypothesised to promote epenthesis where lack of orthography during L2 learning could lead to deletion. This hypothesis, along with others, will be presented in the following chapter and followed by methods used in this study.

Chapter 4. Methodology

4.1 Introduction

In the previous chapter, the author reviewed the literature related to the effects of interlanguage phonology in L2 acquisition, the role of orthography in L2 acquisition, the role of L1 literacy in L2 acquisition, as well as children's phonological error patterns in their L1. This chapter will introduce the research questions, the hypotheses and the methodology. The results of the study will be presented in the following chapter, Chapter 5. Section 4.2 of this chapter gives the research questions and presents the hypothesis of the study. Section 4.3 presents the methodology, with various sub-sections.

4.2 Research Questions and Hypotheses

This study explores how variable exposure to orthographic input and/or aural phonological input affects Arabic-speaking learners' acquisition of a syllable structure more complex than in their L1. It asks the following research questions:

Q1) What role does L1 literacy play when acquiring a new, more complex syllable structure?

Q2) How does seeing words written in L2 during learning influence beginner Arabic-speaking learners' acquisition of English syllable structure? Is there an effect of OI during testing?

To answer these questions, six experimental hypotheses were formulated. As we saw in Chapter 3, section 3.3, literacy is claimed to affect L2 acquisition (e.g. Bigelow and Tarone (2004), Bialystok (2002) and Cummins (1991)) in the way that L1 literacy skills develop the literacy skill of L2. L2 phonologists such as Young-Scholten et al. (1999) and Bassetti (2009) assert that OI might contribute to adult learners' observed low level of phonological attainment by resulting in errors that would not otherwise be produced if learners received only aural input. However, the relation between L1 literacy and adults' acquisition of new phonological forms in a second language has not been studied. Hence, the formulation of the final hypothesis is based on the fact that the orthographic representations of both languages (L1 and L2) are simply not available for non-literate learners because they are not literate in their L1, and in the present study they were also not taught to read in the L2. So, it is hypothesised that:

H1. Those with no native language literacy and only beginning English literacy will epenthesise less than literates who receive only aural input.

H2. Those with no native language literacy and only beginning English literacy will delete more than literates who receive only aural input.

The next three hypotheses were originally proposed by Young-Scholten et al. (1999):

H3. Less epenthesis and more deletion will occur during learning when learners are exposed to only aural input

H4. More epenthesis and less deletion will occur during learning when learners are exposed to orthographic input along with aural input.

H5. Learners who have already received orthographic input during learning epenthesise more when they are exposed to orthographic input during testing vs. only aural input.

The final hypothesis that links literacy with accuracy is that:

H6. Those with no native language literacy and only beginning English literacy will accurately produce words better than literates.

4.3 Methodology

To study the impact of exposure to orthographic input on the acquisition of new phonological forms, the author considered the first language literacy of learners living in a small city in Saudi Arabia and followed the design of Young-Scholten et al. (1999). This choice resulted from careful examination of the research gap, research problem and the type of data to be collected. A quantitative method supplemented by qualitative examination of error type seemed to lead to a comprehensive analysis of the research problem and promised to answer the research questions.

4.4 Participants

Participants were divided into three groups, namely: 1) Non-literate Picture Group, comprising those who were non-literate in Arabic and English and they were taught the English words based on exposure to aural input only; 2) Literate Picture Group, comprising those who were literate in Arabic and they were taught the English words also based on exposure to aural input only; 3a) Literate Word Group, comprising those who were literate in Arabic and they were taught the English words based on exposure to both aural input and conventional orthography but were only tested aurally (post-test 1); and 3b) Literate Word Group-post-test 2, comprising those who were the same participants as the Literate Word Group, but this sub-grouping refers to their results in a second post-test, where the written forms of the words were displayed during their testing. Participants in these groups are described in more detail in the next section.

The targeted population of the present study consisted of 60 native speakers of Najdi Arabic living in Saudi Arabia at the time of testing. This variety of Arabic was chosen purely for reasons of convenience and because it is the variety of Arabic spoken by the author. All participants were males, since this was easier for the researcher because it is not allowed in Saudi culture for a male teacher to recruit and test female participants.

4.4.1 *Non-literate Learners*

There were 20 so-called 'literacy learners' recruited who were in the process of becoming literate in their native Arabic and were living in the Hail region, Saudi Arabia. Since the goal of the present study was to examine the role of orthographic input along with L1 literacy when acquiring new phonological systems, it was essential for one group of participants to be L1 non-literate. The government of Saudi Arabia has been working on literacy programmes by supporting non-literate adults to attend evening classes. No age limit is imposed on those who wish to take advantage. The full programme is three years long for learning the basics of Arabic literacy (Holy Quran, reading other texts and writing). According to statistics from the website of the Ministry of Education, the total number of students attending these literacy programmes since it started has been 43,353, with 18,528 enrolled for the academic year 2014-2015. Considerably more have been female, as only 3,808 were male.

Locally, based on the *Hail News* website, the Director General of Education in Hail declared on Thursday 20th August 2015 that the city was opening 57 education centres for adults and the work of these centres would run for a full academic year. To create a group of non-literate adults, participants were recruited from three different schools, two of them in the city of Hail and one in a village located about 60 kilometres south of Hail city. The urban schools were in Hail and the rural one outside Hail. The author depended on the schools' assessment of their students in choosing the participants. Those who were in the first year were recruited, particularly those who were in the first month of their literacy classes and those who could by that point read Arabic and were in advanced classes were avoided. This meant that all participants in the non-literate group were indeed Arabic non-literates with a similar lack of basic Arabic literacy at the time of testing.

4.4.2 *Literate Learners*

The other two groups comprised 40 Arabic-literate participants living in Hail city. To make sure they had not had any English instruction, recruitment was focused on those who had received their elementary education but had not attended intermediate-level or higher levels of education. English as a foreign language has only recently been taught starting from fourth grade in state schools (at the age of nine years) and the participants had therefore not been exposed to English. The group was literate in Arabic, all having attended school for six years, and there was no variation in their education level. The author recruited these voluntary participants through word of mouth, i.e. friends and relatives who had no prior knowledge of English or English orthography. An English exam was conducted to exclude any participants who could read any letters in the English alphabet. All participants knew nothing beyond 'hello' and 'goodbye' in aural English.

4.5 **Treatment**

4.5.1 *Materials*

There was a total of 46 monosyllabic words with singleton consonants, two-consonant clusters, and three-consonant clusters. A native General American speaker also recorded the words and recorded carrier phrases which were attached to photos in PowerPoint. A total of 26 words of the 46 were divided into categories representing different types of onset and coda clusters in English. Words were divided into categories as shown in Table 4-1 below.

Table 4-1: Word distribution

		Singletons	Consonant Clusters		
			CC	CCC	
Week 1	Lesson 1	book - mug -one - two	horse - snake		6
	Lesson 2	dog – cat – four	three - frog - bird		6
Week 2	Lesson 3	five	six-sky- plane-desk	spray	6
	Lesson 4	seven – eight - nine -ten		text - screen	6
Week 3	Lesson 5	key – pen	shelf - second	desks - first	6
	Lesson 6	door – chair	third - fourth - fifth	sixth	6
Week 4	Lesson 7	date – fig	quail	gifts - street	5
	Lesson 8	nut – rice	plum	square-spring	5
Week 5	Lesson 9		Revision		
	Lesson 10		post-test (s)		46

Categorising started with the seven words with biconsonantal clusters into onsets in Table 4-2, followed by the nine words with biconsonantal clusters in codas in

Table 4-3.

Table 4-2: Two-consonant clusters targeted words (onset position)

Words	snake	frog	three	sky	plane	quail	plum
IPA	/sneɪk/	/fɹaːg/	/θɹiː/	/skʌɪ/	/pleɪn/	/kweɪl/	/plʌm/

Table 4-3: Two-consonant clusters (coda position)

Words	bird	desk	six	shelf	horse	second	third	fourth	fifth
IPA	/bəɹd/	/dɛsk/	/siks/	/ʃɛlf/	/hɔːɹs/	/sekənd/	/θəɹd/	/fɔːɹθ/	/fɪfθ/

Ten target words having three-consonant clusters were learned and tested. Half of them had three-consonant clusters word initially (#CCC) whereas the others had the consonant clusters word finally (CCC#). These words are shown in Table 4-4 below.

Table 4-4: Three-consonant clusters targeted words (coda position)

CCC Word Initial					CCC Word Final				
spray	screen	street	square	spring	desks	sixth	text	first	gifts
/spɹeɪ/	/skɹiːn/	/stɹiːt/	/skweɹ/	/spɹɪŋ/	/dɛsks/	/sɪksθ/	/tɛkst/	/fəɹst/	/gɪfts/

Phrases that were taught (which contained these words) to participants were as follows:

I have a	book; mug; horse; snake; dog; cat; frog; bird.
I have	one Riyal; two Riyals; three Riyals; four Riyals; five Riyals; six Riyals; seven Riyals, eight Riyals, nine Riyals, ten Riyals, three gifts
The	sky is blue; room has seven desks; room has a desk; room has a shelf; room has a computer screen; room has a door; room has a chair.
I read	the text message
I have	a key; a pen
I buy	spray
Hilal is	good team. Hilal is first.
Nasser is	second.
Ahli is	third.
Ittihad is	fourth
Alfateh is	fourth
Al Shabab is	sixth
I eat	a date, a plum, the nut; a fig; rice
I see	a plane; a quail; a street; square
Spring is	good

4.6 **Procedure**

All participants attended ten lessons of 20 minutes each, twice a week for five weeks, given by the researcher. The lessons were designed as beginner English classes and revolved around real words selected for the study. Selection of words was also dictated by the need to present useful words for beginners, as well as by the ability to find pictures to depict the words. This affected the total number of target words in that there was not always equal distribution of syllable types. For example, there were seven words with two-consonant onsets and nine with two-consonant codas. All recordings were recorded by a native speaker of General American which means that participants were exposed to a rhotic accent and clusters with ‘r’ in the coda could be included (e.g. bird, horse and fourth). Singeltons were used as fillers and the rest of the words which have consonant clusters were common words, including the word ‘quail’ which is a well-known bird for the participants. Also, Arabic numerals are different from those used in English, but this did not matter since Arabic speakers are familiar with English-style numerals due to them having them on their watches.

4.6.1 *Ethics*

Since the present study investigates the relation between first language (L1) literacy and the acquisition of a new phonological system, the influence of aural input on L2 phonological acquisition was examined by comparing two types of learners: non-literate and literate.

Before the study started, those who were Arabic literate were given a translated copy of the Information Sheet in Appendix A, and for those who were non-literate, the content of the information sheet was explained clearly to them in Arabic, in their Najdi dialect. Then, both literate and non-literate participants were asked to sign the Consent Form in Appendix B (Arabic version is also attached). Non-literates also signed the consent form similar to those who were literate, using a pen. They usually, however, just wrote the first letter of their name in Arabic.

4.7 **The Lessons**

The study consisted of two phases. The first phase was the learning phase which was divided into two types of exposure: aural input or aural + orthographic input. The second phase was the testing. The following sub-sections present the teaching phase, starting with Picture Groups in 4.7.1 and then the Word Group in 4.7.2. The testing protocol will follow in 4.7.3.

4.7.1 *Picture Group’s Treatment*

The author, an experienced English teacher, taught the classes. In the first eight lessons, learners in all groups were taught six new words in each lesson and were asked to do some exercises which included looking at photos (and written words, for that group) on a PowerPoint show and listening to the name of the item in the photo. The researcher was somewhat restricted by a specific time, as the school headteachers/principals expected the learners to benefit from the study. Therefore, no new words were introduced after Lesson 8. To make sure all words had been learned, revision was done in Lesson 9. Learners then took the post-test(s) (see below) during the final lesson.

Lessons were divided into categories, such as animals, numbers, fruits, and food. At the beginning of a lesson, participants were given a preview in Arabic about what they would learn. During teaching of the words to all groups, the author intentionally refrained from pronouncing the target words to make sure the participants were never exposed to examples of non-native pronunciation. In Lesson 1, for example, words were sorted into main categories (book - mug), (horse - snake) and (1 and 2). For the Picture Group(s), starting with 'book' for example, a photo was displayed and the recording was played five times (as in Figure 4-1 below and all lessons in Appendix C).

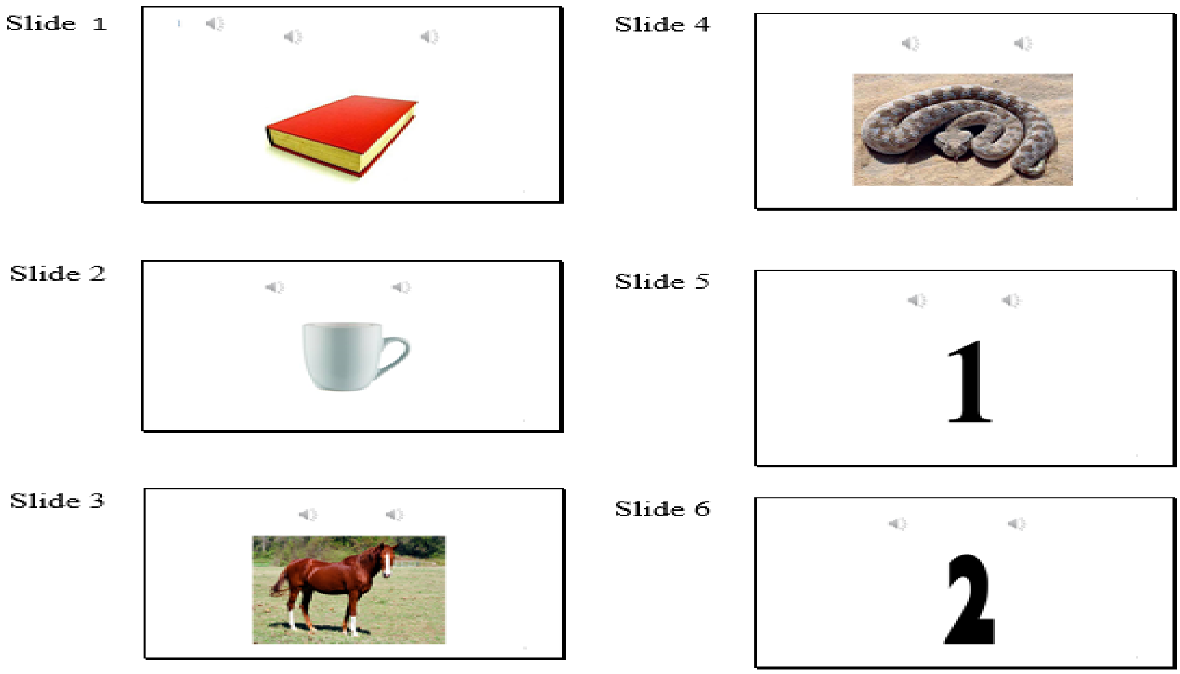


Figure 4-1: Lesson 1 (Picture Groups)

Relevant additional information was used to teach the words; i.e. hand gestures were used to teach numbers and concrete objects were used to teach words like 'mug', 'book,' 'chair', and 'desk. Sometimes the researcher depended on the displayed photos to teach words like 'horse' and 'snake'. Then the PPT was re-run where the carrier phrases were used – three times - to practise the words. This means that participants were exposed to the aural input of a word, such as *'book',* five times in the first stage of the teaching phase and then three more times when they heard it in the carrier phrase: *'I have a book'*. At the end of the lesson, copies of the target words' photos were distributed and participants were informally tested on what they had learnt. For example, participants were given a photo of a mug and the researcher asked participants in Arabic 'what do you have?' When one of the participants pronounced the word, the teacher immediately encouraged him in Arabic and the recording was replayed once (the recording that matched the distributed photo which was produced by the participant) asking other participants to produce the word loudly. This process was repeated for the rest of the target words of the lesson for that teaching day. Since the number of attendees at a lesson did not exceed ten participants and the target words did not exceed six words per lesson, this facilitated the process of ensuring that each participant was given a chance and was encouraged to pronounce all words taught in the lesson. Instructions were entirely in Arabic and participants were asked to depend on the recordings.

In the following lesson, all words taught in previous lesson(s) were revised by displaying the photos and re-playing the recordings twice for each word (but only the words, without the carrier phrases, to save time). On the last learning day, i.e. Lesson 9, participants were given a complete revision of the words from all previous lessons. To assess their learning, participants were then given multiple choice questions. They were asked to choose the photo from an array of four photos where only one matched the recording played, as in Figure 4-2 below (a copy of the exercises is available in Appendix C for the Picture Groups). Then they were tested on their pronunciation of these words; this is discussed further below.

Figure 4-2: Revision - Picture Groups

4.7.2 *Word Group's Treatment*

The procedure described above for the Picture Groups was also followed for the Word Group. As the present study aimed to contribute towards understanding the influence of exposing L2 learners to the orthographic input of the target language typically from the start for adult learners of English as a foreign language, how learners are introduced to the English writing system was the standard way of doing so. In this case, it involved using a whiteboard. The materials for introducing English writing were adopted from the Ministry of Education for

English beginner adult evening classes. During these lessons and to expose participants to more orthography, they were taught the English alphabet, some colours and adjectives while the author avoided any words that could introduce more complex onsets or codas to the group. After introducing the participants to the written English, they were taught the words shown in Table 4-1 (a sample is given in Appendix D). While introducing them to the English alphabet, the author depended on audio material supplied from the Ministry of Education in Saudi Arabia, where the accent used is General American.

What differed for this group was that the written forms of the target words (as shown in Table 4-1) were attached to the photos the learners saw (as in Figure 4-3 below and the full lessons in Appendix E). The learners did not have more exposure to the words than the Picture Group(s).

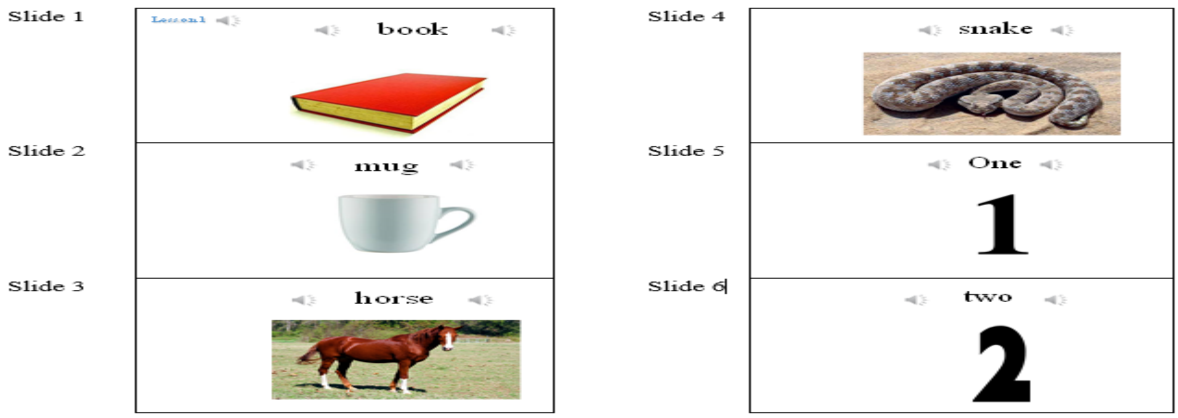


Figure 4-3: Lesson 1 (Word Group)

Similar to the last learning day of teaching for the Picture Groups, i.e. in Lesson 9, participants were given a complete revision of the words from all previous lessons. The only difference was the availability of the orthographic representations of the words, as shown in Figure 4-4 (see complete revision in Appendix E).

Figure 4-4: Revision - Word Group

4.7.3 *Testing Protocol*

On the last day, each of the 60 participants was tested individually. Except for the third group when tested a second time, the written form of the words as well as the sound files were removed and photos were displayed. Participants were asked to name the picture shown on each slide (as in Figure 4-5) and their pronunciation was recorded using a Sony Digital Voice Recorder with a built in microphone.

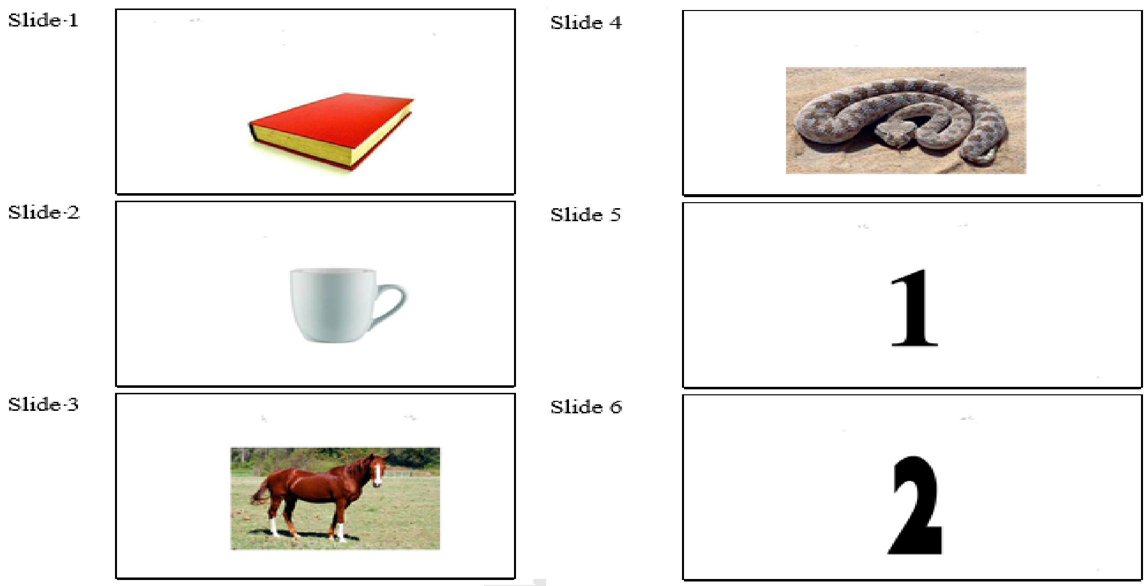
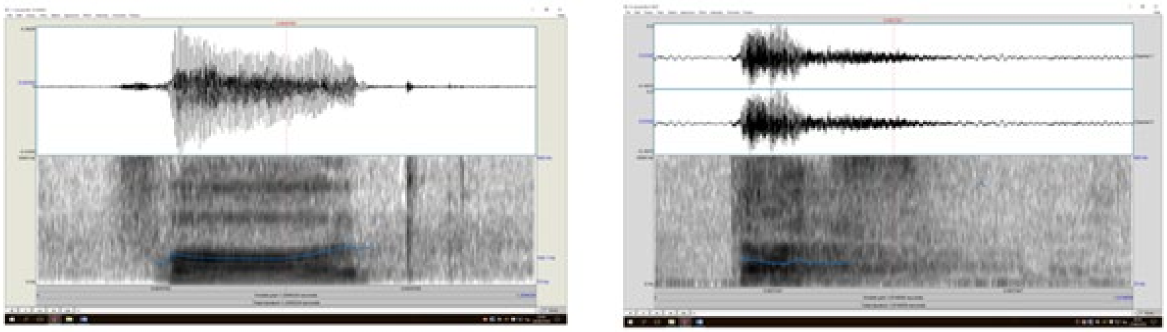


Figure 4-5: Post-test 1 (Picture Groups and Word Group)

The Word Group was given a second post-test where the written forms of the words were displayed to discover if seeing words written during testing influenced their production (Young-Scholten et al., 1999; Rafat, 2011).

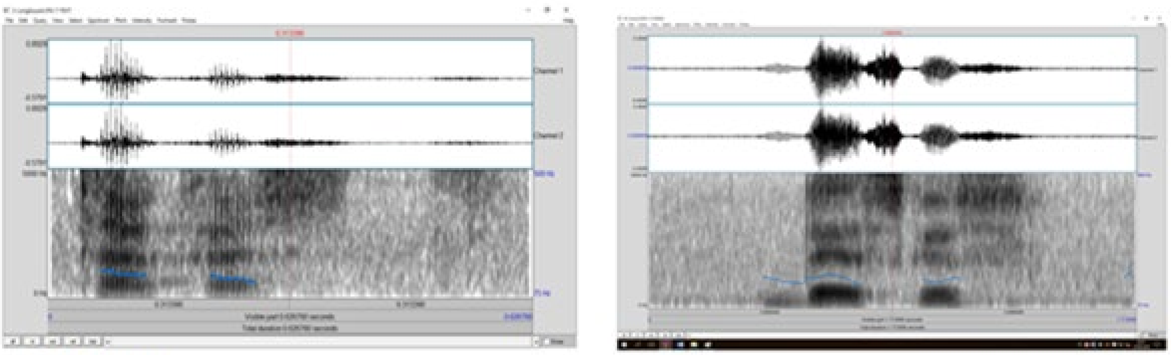
4.8 Data Analysis

The recordings of participants were subjected to quantitative data analysis. Tokens of every participant were first transcribed according to the International Phonetic Alphabet (IPA; see Appendix F). They were transcribed by the author and checked by a speaker of another language, a bilingual speaker of Hindi and English trained in IPA. The transcriptions were also checked through Praat by analysing a sample of the tokens (52 tokens out of 2032 were randomly checked); a Praat sample is shown in Figure 4-6 where the speaker has deleted a consonant and in Figure 4-7 where the speaker has epenthesised a vowel.[7] More examples of the Praat spectrograms are given in Appendix G (all 52 spectrograms). The recordings were fairly low quality due to the fact that they were done in non-laboratory conditions.



NL 13 [faːg]   NL 3 [tɛks]

Figure 4-6: Example of deletion



LP 7 [tɛ.kist]   LW 1- 15 [dɛs.kis]

Figure 4-7: Example of epenthesis

Once the transcriptions were completed, the number of times learners epenthesised as well as deleted in both types of clusters in the Non-literate Picture Group were compared with the Literate Picture Group to see if L1 literacy affects L2 phonological acquisition. The Literate Picture Group was compared to the Literate Word Group-test 1 to see the difference between

[7] Abbreviations:
NL= Non-literate Picture Group
LP = Literate Picture Group
LW1 = Literate Word Group
LW2 = Literate Word Group post-test 2
Where these abbreviations are followed by a number, this refers to the participant. For example, NL 13 = Non-literate Picture Group participant number 13.

exposing learners to aural input only and exposing them to the orthographic input along with aural input. In addition, to discover whether seeing words during testing affects learners' acquisition, the author looked at the effect of orthography during testing and compared the Literate Word Group-test 2 with the Literate Word Group-test 1. The results were analysed via the use of SPSS to show the statistics that support the hypotheses of this research.

4.9 Chapter Summary

This chapter started by hypothesising that exposure to orthographic input leads to more vowel epenthesis and less consonant deletion, while aural input leads to more consonant deletion and less vowel epenthesis. It was further hypothesised that non-literate learners will epenthesise less and delete more than literates. This was followed by a detailed description of the methods used to conduct this study. A quantitative approach was chosen after careful examination of the research questions and hypotheses; this approach was chosen to comprehensively answer the questions of this research. In the following chapter, results of the study will be comprehensively presented.

Chapter 5. Results

5.1 Introduction

This chapter starts with a presentation of the results relating to the number of target words learned by the participant groups in section 5.2. Then, the overall results regarding accuracy rates on the one hand and epenthesis and deletion rates on the other are presented, respectively, in sections 5.3 and 5.4 for all groups to give an idea about the general performance of participants. The chapter then focusses on detailed results along with descriptive statistics of specific groups in sections 5.5 to 5.8, making comparisons that allow for hypothesis testing. In all sections, the results of participants' performance in bi-consonantal cluster contexts and tri-consonantal cluster contexts are presented together. Section 5.9 gives a qualitative account of the phonetic and phonological observations of the errors learners in the three groups made. The chapter is concluded in section 5.10.

The hypotheses and some of the study's key details are repeated hereunder for clarity and ease of reference (the reader is referred to Chapter 4, section 4.2 for more details):

- H1. Those with no native language literacy and only beginning English literacy will epenthesise less than literates who receive only aural input.
- H2. Those with no native language literacy and only beginning English literacy will delete more than literates who receive only aural input.
- H3. Less epenthesis and more deletion will occur during learning when learners are exposed to only aural input.
- H4. More epenthesis and less deletion will occur during learning when learners are exposed to orthographic input along with aural input.
- H5. Learners who have already received orthographic input during learning epenthesise more when they are exposed to orthographic input during testing vs. only aural input.
- H6. Those with no native language literacy and only beginning English literacy will accurately produce words better than literates.

As previously mentioned, in this study, 60 Najdi Arabic speakers were taught 46 English vocabulary items over a period of five weeks. At the end of the teaching period, the beginners' production of the taught items was tested by showing them a picture and asking them to name it, and then for the Word Group, immediately testing them a second time with written words. Participants' results were divided into three groups: Non-literate Picture Group (NL), Literate

Picture Group (LP), Literate Word Group (LW1) (tested twice: test 1 and test 2 (LW2) and, thus, these will be referred to as LW1 and LW2).

The comparisons that will be made to test these hypotheses are between (1) NL and LP groups, (2) LP and LW1 groups, and (3) LW group in two conditions, namely LW1 and LW2. These are dealt with in separate sections below (5.5 to 5.7). As this study investigates the acquisition of a new phonological system by exposing learners to two versions of the same educational method where the difference was the presentation of the English alphabet and written words, and as the words and the testing involved two- and three-consonant onset and coda clusters, mentioning hypotheses before each separate set of results will result in repetition of these hypotheses. Therefore, the author will evaluate the hypotheses in section 5.8.

IBM SPSS Statistics version 24 was used in the analysis of the results. Participants' individual results by epenthesis and deletion contexts were coded into SPSS as participant proportions (i.e. proportion of epenthesis, deletion or correct production out of all produced contexts) rather than integers. This was a necessary step because the number of words learnt (as will be shown and discussed in section 5.2) varied between participants and thus integers referring to epenthesis, deletion or correct occurrences in the production of different participants are not based on the same fixed amounts and are not meaningful by themselves. Data were tested for normal distribution. Some of the variables were not normally distributed. Therefore, for robust statistics, non-parametric tests were used (Larson-Hall, 2010) and hence Mann-Whitney and Wilcoxon Signed Rank tests, which are non-parametric equivalents of the t-test, were chosen. While Mann-Whitney is used for independent samples and thus used in this chapter to compare the means of different groups, Wilcoxon Signed Rank is used for dependent samples and thus used in this chapter to compare different variables by the same group of participants.

5.2 **Learning Issues**

Since learners had to learn the words on which they were then tested, the number of target words learned by each participant varied because some participants did not remember the target word(s) when tested despite efforts made to make sure they did (see previous chapter). Looking at this by group in Table 5.1, the lowest number of words learnt was achieved by the Non-literate Picture Group, while the highest number was learnt by those who were exposed to the orthographic input (Word Group(s)). Participants' number of tokens are shown in Table 5-1.

Table 5-1: Number of tokens learnt by groups

Groups	Type of Consonants					
	Two-consonant Clusters			Three-consonant Clusters		
	#CC	CC#	#CC & CC#	#CCC	CCC#	#CCC & CCC#
Number of Words Learnt	140	180	320	100	100	200
NL	135	170	305	91	92	183
LP	139	174	313	92	95	187
LW1	139	178	317	100	100	200
LW2	139	179	318	100	100	200

The table above shows that the total number of words learned by LP is slightly higher than those learned by participants with no L1 literacy (NL). Those who were exposed to the orthographic input (LW1 and LW2) learned slightly more words than those who were exposed to only picture input (NL and LP). This difference of learning becomes seemingly more noticeable when dealing with tri-consonant clusters. Mann-Whitney tests comparing the total number of words, containing two-consonant clusters and three-consonant clusters separately, learned by different groups, revealed that there were no statistically significant differences between NL, LP or LW in the total number of learned words containing two-consonant clusters. However, as for the total number of learned words containing three-consonant clusters, there were significant differences between LW and both NL ($U = 104$, $Z = 3.401$, $p = .009$) and LP ($U = 95$, $Z = 3.633$, $p = .004$). However, NL and LP did not differ statistically.

The following section presents the overall accuracy rates for all groups.

5.3 Accuracy Rates in Two-consonant and Three-consonant Clusters: All Groups

Table 5-2 presents the overall accuracy rates for all groups in the two- and three-consonant cluster in word-initial and word-final positions.

Table 5-2: Accuracy rates in two-consonant and three-consonant clusters by position and by group

Groups	#CC	CC#	#CCC	CCC#
NL	127/135 (94.07%)	127/170 (74.70%)	61/91 (67.03%)	36/92 (39.13%)
LP	129/139 (92.80%)	133/174 (76.43%)	54/92 (58.69%)	31/95 (32.63%)
LW1	135/139 (97.12%)	165/178 (92.69%)	46/100 (46%)	53/100 (53%)
LW2	137/139 (98.56%)	167/178 (93.82%)	37/100 (37%)	49/100 (49%)
*Cells show number of correctly produced clusters / number of words produced by participants (Group Mean %)				

Table 5-2 generally shows that all groups were noticeably more accurate in producing two-consonant than three-consonant clusters. This was confirmed by Wilcoxon Signed Rank test results comparing accuracy rates of two-consonant clusters and three-consonant clusters for each group separately *(NL: Z= 3,696, p = .000; LP: Z= 3.809, p = .000; LW1: Z= 3.823, p = .000; LW2: Z= 3,924, p = .000)*.

Wilcoxon Signed Rank test results showed that clusters in initial position were produced more accurately than clusters in final position by NL and LP groups *(#CC vs CC# by NL: Z= 3,698, p = 000; #CCC vs CCC# by NL: Z= 2.492, p = .013; #CC vs CC# by LP: Z= 3,119, p = .002; #CCC vs CCC# by LP: Z= 2.209, p = .027)*, but not by LW1 and LW2 *(#CC vs CC# by LW1: Z= 1,583, p = .113; #CCC vs CCC# by LW1: Z= .684, p = .494; #CC vs CC# by LW2: Z= .441, p = .526;#CCC vs CCC# by LW2: Z= 1,529, p = .126).*

Group comparisons were made between 1) NL and LP, 2) LP and LW1, and 3) LW in two conditions (LW1 and LW2). While a Mann-Whitney test was used to compare the group results of NL, LP and LW1, a Wilcoxon Signed Rank test was used to compare the results of LW1 and LW2 (because these are the same group tested in two conditions). To maintain clarity in presentation, statistical test results are presented in Table 5-3. It can be seen here that groups did not differ in their accuracy in producing clusters of both types and positions, except for one case in which LW1 produced word-final two-consonant clusters significantly more accurately than LP.

Table 5-3: Statistical test results for group-accuracy-rate comparisons by consonant cluster type and position

	NL vs LP[(a)]	LP vs LW1[(a)]	LW1 vs LW2[(b)]
#CC	U = 186, Z = .434, p = .665	U = 150, Z = 1.644, p = .100	Z = .917, p = .359
CC#	U = 190, Z = .274, p = .784	U = 74, Z = 3.502, p = .000	Z = .215, p = .830
#CCC	U = 190, Z = .263, p = .793	U = 168, Z = .869, p = .385	Z = .615, p = .538
CCC#	U = 168, Z = .878, p = .380	U = 129, Z = 1.931, p = .053	Z = .277, p = .782
(a): This is based on Mann-Whitney test (b): This is based on Wilcoxon Signed Rank test			

To sum up the accuracy rates presented in this section, it was found that all groups produced two-consonant clusters more accurately than three-consonant clusters and NL and LP groups (but not LW1 and LW2) were more accurate in word-initial than word-final clusters. Moreover, group comparisons revealed that NL and LP did not differ in their performance and LP and LW1 differed only in word-final two-consonant cluster production, as the latter were significantly more accurate. In addition, the production of the LW group did not differ between LW1 and LW2.

The following section reports epenthesis and deletion rates by all groups.

5.4 Epenthesis and Deletion in Two-consonant and Tri-consonant Clusters: All Groups

Table 5-4 shows the results of epenthesis and deletion in two-consonant and three-consonant clusters in word-initial (#CC and #CCC) and word-final (CC# and CCC#) contexts.

Table 5-4: Epenthesis (Epen) and deletion (Del) in two-consonant and three consonant clusters by position and by group

Groups	#CC		CC#		#CCC		CCC#	
	Epen	Del	Epen	Del	Epen	Del	Epen	Del
NL	0/135 (0%)	8/135 (5.93%)	2/170 (1.18%)	41/170 (24.12%)	9/91 (9.89%)	21/91 (23.08%)	6/92 (6.52%)	50/92 (54.35%)
LP	0/139 (0%)	10/139 (7.19%)	6/174 (3.45%)	35/174 (20.11%)	33/92 (35.87%)	5/92 (5.43%)	15/95 (15.79%)	49/95 (51.58%)
LW1	0/139 (0%)	4/139 (2.88%)	6/178 (3.37%)	8/179 (4.47%)	50/100 (50%)	4/100 (4%)	27/100 (27%)	20/100 (20%)
LW2	0/139 (0%)	2/139 (1.44%)	8/178 (4.49%)	4/179 (2.23%)	62/100 (62%)	1/100 (1%)	39/100 (39%)	12/100 (12%)

*Cells show epenthesis / number of words learnt (Group Mean %) or deletion / number of words learnt (Group Mean %)

It can be seen in Table 5-4 that all groups simplified word-initial two-consonant clusters by deletion and none of them epenthesised in this position. However, in word-final two-consonant clusters, both epenthesis and deletion strategies were observed; deletion was more prevalent than epenthesis in the production of NL and LP.

In three-consonant cluster contexts, the picture is different than for two-consonant clusters. Word-initial clusters were simplified by epenthesis more than deletion by all groups, except for NL whose members deleted more than they epenthesised. Different patterns can be observed in word final position tri-consonantal clusters; while deletion was seemingly higher than epenthesis for NL and LP, the reverse was true for LW in post-test 1 (LW1) and post-test 2 (LW2).

To get better insights into these results and to allow for hypothesis testing, the following three sections focus on providing more detailed descriptive statistics and statistical test results, comparing the performance of 1) NLP vs. LP (in section 5.5), 2) LP vs. LW1 (in section 5.6), and 3) LW1 vs. LW2 (in section 5.7).

5.5 Non-literate Picture (NL) Group and Literate Picture (LP) Group Comparisons

In this sub-section, literacy as a variable will be tested by comparing the results of the NLP and LP groups. Comparisons will be made by showing the descriptive statistics, with Wilcoxon Signed Rank tests (dependent samples) and Mann-Whitney tests (independent samples) for each type of consonant cluster. Table 5-5 provides descriptive statistics for the results of epenthesis and deletion in two-consonant and three-consonant cluster contexts in the production of NLP and LP groups and Table 5-6 compares the means.

Table 5-5: NL and LP groups' descriptive statistics for epenthesis and deletion in two-consonant and three-consonant clusters in all positions

Descriptive Statistics					
Groups		Mean	Std. Deviation	Minimum	Maximum
Non-literate Picture (NL) Group	#CC EPENTHESIS	.00	.00	0	0
	#CC DELETION	5.93	8.82	.00	28.57
	CC# EPENTHESIS	1.18	3.41	.00	11.11
	CC# DELETION	24.12	11.30	11.11	44.44
	#CCC EPENTHESIS	9.89	22.63	.00	66.67
	#CCC DELETION	23.8	26.01	.00	75.00
	CCC# EPENTHESIS	6.52	9.40	.00	20.00
	CCC# DELETION	54.35	27.06	.00	100.00
Literate Picture (LP) Group	#CC EPENTHESIS	.00	.00	0	0
	#CC DELETION	7.19	8.78	.00	28.57
	CC# EPENTHESIS	3.45	5.34	.00	12.50
	CC# DELETION	20.11	11.56	.00	37.50
	#CCC EPENTHESIS	35.87	36.68	.00	100.00
	#CCC DELECTION	5.43	17.41	.00	75.00
	CCC# EPENTHESIS	15.79	20.05	.00	75.00
	CCC# DELETION	51.58	27.78	.00	100.00

It is clear from Table 5-5 that in two-consonant cluster contexts both NL and LP groups preferred to delete clusters than to epenthesise. Indeed, comparisons of epenthesis and deletion rates in two-consonant cluster contexts by the same group revealed significant differences with an advantage for deletion, as the results of the Wilcoxon Signed Rank test presented in Table 5-6 show.

Table 5-6: Wilcoxon Signed Rank test results for comparisons between epenthesis and deletion rates in two-consonant cluster contexts by the same groups

	NL	LP
#CC Epenthesis vs. Deletion	Z= -2.414, p= .016	Z= -2.807, p= .005
CC# Epenthesis vs. Deletion	Z= -3.835, p= .000	Z= -3.531, p= .000
#CC and CC# Epenthesis vs. Deletion	Z= -3.827, p= .000	Z= -3.765, p= .000

This leads to Finding 1.

Finding 1: NL and LP learners similarly simplify bi-consonantal clusters in word-initial and word-final positions by deletion significantly more than by epenthesis.

To test for first language (L1) literacy effects in two-consonant cluster contexts, a Mann-Whitney test was used to compare the NL and LP results; no significant results were found, as Table 5-5 shows.

Table 5-7: Mann-Whitney test results for comparisons of epenthesis and deletion in two-consonant clusters between NL and LP groups

	NL vs. LP
#CC EPENTHESIS	U = 200, Z = .000, p = 1.000
#CC DELETION	U = 186, Z = -.43, p = .665
CC# EPENTHESIS	U = 159, Z = -1.59, p = .111
CC# DELETION	U = 165, Z = -.945, p = .345
#CC & CC# EPENTHESIS	U = 159, Z = -1.59, p = .111
#CC & CC# DELETION	U = 169, Z = -.834, p = .404

This leads to Finding 2.

Finding 2: No L1 literacy effects are found in the production of word-initial or word-final bi-consonantal clusters.

Moving to three-consonant cluster contexts, as is clear from Table 5-5 above, higher rates of deletion than epenthesis were observed in the performance of both groups, except for LP production of word-initial three-consonant clusters where more epenthesis than deletion was seen. These were found statistically significant as the Wilcoxon test results show in Table 5.8.

Table 5-8: Wilcoxon Signed Rank test results for comparisons between epenthesis and deletion rates in three-consonant cluster contexts by the same groups

	NL	LP
#CCC Epenthesis vs. Deletion	Z= -1.612, p= .107	Z= -3.087, p= .002
CCC# Epenthesis vs. Deletion	Z= -3.821, p= .000	Z= -3.086, p= 002
#CCC and CCC# Epenthesis vs. Deletion	Z= -3.745, p= .000	Z= -.546, p= .585

This leads to Finding 3.

Finding 3: In tri-consonantal cluster contexts, while NL learners delete more than they epenthesise in word-initial position and word-final position, the LP learners epenthesise more than they delete in word-initial position and do the reverse in word-final position.

Mann-Whitney test results revealed some literacy effects, as Table 5-9 below shows. The NL learners epenthesise less and delete more than LP learners in word-initial tri-consonantal clusters. Although the same pattern appears in word-final position, the results did not reach significance here.

Table 5-9: Mann-Whitney test results for comparisons of epenthesis and deletion in three-consonant clusters between NL and LP groups

	NL vs. LP
#CCC EPENTHESIS	U = 112, Z = -2.54, p = .01
#CCC DELETION	U = 105, Z = -2.95, p = .003
CCC# EPENTHESIS	U = 141, Z = -1.82, p = .07
CCC# DELETION	U = 180, Z = -.534, p = .593
#CCC & CCC# EPENTHESIS	U = 97, Z = -2.83, p = .005
#CCC & CCC# DELETION	U = 141, Z = -1.60, p = .109

This leads to Finding 4.

Finding 4: NL learners delete more and epenthesise less than LP learners in word-initial tri-consonantal clusters.

The following section compares the results of LP and LW1 groups.

5.6 Literate Picture (LP) Group and Literate Word Group post-test 1 (LW1) Comparisons

Descriptive statistics for results in two-consonant and three-consonant clusters are presented first in Table 5-10.

Table 5-10: LP and LW1 groups' descriptive statistics for epenthesis and deletion in two-consonant and thee-consonant clusters in all positions

Descriptive Statistics					
Groups		Mean	Std. Deviation	Minimum	Maximum
Literate Picture (LP) Group	#CC EPENTHESIS	.00	.00	0	0
	#CC DELETION	7.19	8.78	.00	28.57
	CC# EPENTHESIS	3.45	5.34	.00	12.50
	CC# DELETION	20.11	11.56	.00	37.50
	#CCC EPENTHESIS	35.87	36.68	.00	100.00
	#CCC DELECTION	5.43	17.41	.00	75.00
	CCC# EPENTHESIS	15.79	20.05	.00	75.00
	CCC# DELETION	51.58	27.78	.00	100.00
Literate Word Group post-test 1 (LW1)	#CC EPENTHESIS	.00	.00	0	0
	#CC DELETION	2.88	6.12	.00	16.67
	CC# EPENTHESIS	3.37	5.34	.00	12.50
	CC# DELETION	4.47	8.37	.00	22.22
	#CCC EPENTHESIS	50.00	39.18	.00	100.00
	#CCC DELETION	4.00	8.20	.00	20.00
	CCC# EPENTHESIS	27.00	26.96	.00	100.00
	CCC# DELETION	20.00	18.35	.00	60.00

In two-consonant cluster contexts, as Table 5-10 shows, there was no epenthesis in word-initial position and low rates of epenthesis in word-final position for both groups. Although deletion was more prevalent than epenthesis for both groups, low rates of deletion in all word positions can be seen for LW1 learners. One noticeable difference between the two groups is that while deletion is significantly higher than epenthesis in the performance of the LP group, the difference between the two strategies is no more significant in the performance of the LW1 group than the results of the Wilcoxon Signed Rank test results presented in Table 5-11 show.

Table 5-11: Wilcoxon Signed Rank test results for comparisons between epenthesis and deletion rates in two-consonant cluster contexts by the same group

	LP	LW1
#CC Epenthesis vs. Deletion	Z= -2.807, p= .005	Z= -1.890, p= .059
CC# Epenthesis vs. Deletion	Z= -3.531, p= .000	Z= -.351, p= .726
#CC and CC# Epenthesis vs. Deletion	Z= -3.765, p= .000	Z= -1.421, p= .155

This leads to Finding 5.

Finding 5: Exposure to orthographic along with aural input reduces deletion, which in turn decreases the difference between the use of deletion and that of epenthesis when learners simplify bi-consonantal clusters in word-initial and final-positions.

To test for group differences in two-consonant cluster contexts, Mann-Whitney was used to compare the results. The only significant difference was found in deletion in word-final position clusters, as the LW1 learners deleted less than the LP learners, as is shown in Table 5-12.

Table 5-12: Mann-Whitney test results for comparisons of epenthesis and deletion in two-consonant clusters between LP and LW groups

	LP vs. LW1
#CC EPENTHESIS	U = 200, Z = .000, p = 1.000
#CC DELETION	U = 150, Z = -1.64, p = .100
CC# EPENTHESIS	U = 200, Z = .000, p = 1000
CC# DELETION	U = 55, Z = -4.09, p = .000
#CC & CC# EPENTHESIS	U = 197, Z = -.101, p = .920
#CC & CC# DELETION	U = 44, Z = -4.31, p = .000

This leads to Finding 6a and Finding 6b.

Finding 6a: Exposure to orthographic input along with aural input causes less deletion in word-final bi-consonantal clusters, but it has no effect on epenthesis.

Finding 6b: Exposure to only aural input causes more deletion in word-final bi-consonantal clusters, but it has no effect on epenthesis.

Moving to three-consonant cluster contexts, Table 5-10.

Table 5-10 above shows higher epenthesis rates in word initial position for both groups (LP and LW1). In word final position, both simplifying strategies are used by the two groups. To test for differences between the strategies used by both groups to simplify tri-consonantal clusters, a Wilcoxon Signed Rank test was used to compare the results (see Table 5-13 below). For both groups, epenthesis was significantly higher than deletion in word initial position. However, in word-final position, while the LP learners deleted more than they epenthesised, the LW1 learners' results showed no difference between these simplification strategies.

Table 5-13: Wilcoxon Signed Rank test results for comparisons between epenthesis and deletion rates in three-consonant cluster contexts by the same groups

	LP	LW1
#CCC Epenthesis vs. Deletion	Z= -3.087, p= .002	Z= -3.221, p= .001
CCC# Epenthesis vs. Deletion	Z= -3.086, p= 002	Z= -.749, p= .454
#CCC and CCC# Epenthesis vs. Deletion	Z= -.546, p= .585	Z= -3.065, p= .002

This leads to Finding 7.

Finding 7: Exposure to orthographic along with aural input reduces deletion, which in turn decreases the difference between the use of deletion and that of epenthesis to simplify tri-consonantal clusters in word-final position.

Group results showed significantly less deletion in the production of LW1 learners than that of the LP group, as attested by the Mann-Whitney test results presented in Table 5-14. No significant results were found for all other comparisons between the two groups.

Table 5-14: Mann-Whitney test results for comparisons of epenthesis and deletion in three-consonant clusters between LP and LW1 groups

	LP vs. LW1
#CCC EPENTHESIS	U = 168, Z = -.877, p = .380
#CCC DELETION	U = 192, Z = -.328, p = .743
CCC# EPENTHESIS	U = 149, Z = -1.47, p = .141
CCC# DELETION	U = 71, Z = -3.55, p = .000
#CCC & CCC# EPENTHESIS	U = 152, Z = -1.29, p = .196
#CCC & CCC# DELETION	U = 73, Z = -3.48, p = .000

Based on this, Finding 8a and Finding 8b are presented below.

Finding 8a: Exposure to orthographic input along with aural input causes less deletion in word-final tri-consonantal clusters, but it has no effect on epenthesis.

Finding 8b: Exposure to only aural input causes more deletion in word-final tri-consonantal clusters, but it has no effect on epenthesis.

The author will now turn to comparisons between LW1 and LW2. It is worth reminding the reader that this was one group that was tested twice. The only difference was that LW2 was exposed to the orthographic transcription of words during testing (see Chapter 4, section 4.7.3 for rationale), i.e. tested a second time.

5.7 Literate Word Group post-test 1 (LW1) and Literate Word Group-post-test 2 (LW2) Comparisons

Descriptive statistics for results in two-consonant and three-consonant clusters are presented first in 5-15.

Table 5-15: LW1 and LW2 descriptive statistics for epenthesis and deletion in two-consonant and three-consonant clusters in all positions

Descriptive Statistics					
Groups		Mean	Std. Deviation	Minimum	Maximum
Literate Word Group post-test 1 (LW1)	#CC EPENTHESIS	.00	.00	0	0
	#CC DELETION	2.88	6.12	.00	16.67
	CC# EPENTHESIS	3.37	5.34	.00	12.50
	CC# DELETION	4.47	8.37	.00	22.22
	#CCC EPENTHESIS	50.00	39.18	.00	100.00
	#CCC DELETION	4.00	8.20	.00	20.00
	CCC# EPENTHESIS	27.00	26.96	.00	100.00
	CCC# DELETION	20.00	18.35	.00	60.00
Literate Word Group post-test 2 (LW2)	#CC EPENTHESIS	.00	.00	0	0
	#CC DELETION	1.44	4.39	.00	14.29
	CC# EPENTHESIS	4.49	5.67	.00	12.50
	CC# DELETION	2.23	6.83	.00	22.22
	#CCC EPENTHESIS	62.00	31.43	.00	100.00
	#CCC DELETION	1.00	4.47	.00	20.00
	CCC# EPENTHESIS	39.00	25.52	20.00	100.00
	CCC# DELETION	12.00	13.61	.00	40.00

As Table 5-15 shows, in two-consonant cluster contexts, very low rates of epenthesis and deletion in word-initial and word-final clusters can be seen overall in the performance of LW1 and LW2. Wilcoxon Signed Rank test results in Table 5-16 show no difference between the epenthesis and deletion strategies used by the LW group when tested twice, i.e. LW1 and LW2.

Table 5-16: Wilcoxon Signed Rank test results for comparisons between epenthesis and deletion rates in two-consonant cluster contexts by the same group

	LW1	LW2
#CC Epenthesis vs. Deletion	Z= -1.890, p= .059	Z= -1.414, p= .157
CC# Epenthesis vs. Deletion	Z= -.351, p= .726	Z= -1.508, p= .132
#CC and CC# Epenthesis vs. Deletion	Z= -1.421, p= .155	Z= -.702, p= .483

Furthermore, Wilcoxon Signed Rank test results comparing the means of LW1 and LW2 do not show significant differences, as presented in Table 5-17.

Table 5-17: Wilcoxon Signed Rank test results for comparisons of epenthesis and deletion in two-consonant clusters between LW1 and LW2

	LW1 vs. LW2
#CC EPENTHESIS	Z = .000, p = .1000
#CC DELETION	Z = -1.342, p = .180
CC# EPENTHESIS	Z = -.557, p = .577
CC# DELETION	Z = -1.633, p = .102
#CC & CC# EPENTHESIS	Z = -.577, p = .577
#CC & CC# DELETION	Z = -1.530, p = .110

This leads to Finding 9.

Finding 9: Exposure to orthographic transcriptions during testing does not have any effect on the production of word-initial and word-final bi-consonantal clusters.

Results of three-consonant clusters production by the same groups are presented next.5-15.

Table 5-15 above shows that both LW1 and LW2 relied more on epenthesis than deletion strategy in simplifying three-consonant clusters in word-initial and word final-positions. These differences were found to be significant for LW, i.e. LW1 vs. LW2 by the results of the Wilcoxon Signed Rank test presented in Table 5-18.

Table 5-18: Wilcoxon Signed Rank test results for comparison between epenthesis and deletion rates in three-consonant cluster contexts by LW1 and LW2

	LW1	LW2
#CCC Epenthesis vs. Deletion	Z= -3.221, p= .001	Z= 3.673, p= .000
CCC# Epenthesis vs. Deletion	Z= -.749, p= .454	Z= -3.209, p= .001
#CCC and CCC# Epenthesis vs. Deletion	Z= -3.065, p= .002	Z= -3.933, p= .000

To test for the effect of exposure to orthographic transcription during testing, Wilcoxon Signed Rank was used to compare the results of this group on two occasions (LW1 and LW2). The only difference found was in the total amount of deletion, as LW2 deleted less than LW1. Wilcoxon Signed Rank results are given in Table 5-19.

Table 5-19: Wilcoxon Signed Rank results for comparisons of epenthesis and deletion in three-consonant clusters between LW1 and LW2

	LW1 vs. LW2
#CCC EPENTHESIS	Z = -1.869, p = .062
#CCC DELETION	Z = -1.242, p = .180
CCC# EPENTHESIS	Z = -.1.620, p = .071
CCC# DELETION	Z = -1.760, p = .068
#CCC & CCC# EPENTHESIS	Z = -1.470, p = .110
#CCC & CCC# DELETION	Z = -2,636, p = .008

This leads to Finding 10.

Finding 10: Exposure to orthographic transcriptions has an effect on the production of tri-consonantal clusters in terms of less deletion. No effect on epenthesis was found.

The next section now summarises the support for the hypotheses tested.

5.8 Summary of Hypotheses and Support

H1. Those with no native language literacy and only beginning English literacy will epenthesise less than literates who receive only aural input.

H2. Those with no native language literacy and only beginning English literacy will delete more than literates who receive only aural input.

The evidence for and against these hypotheses comes from the comparisons between the Non-literate and Literate Picture Groups' performance. Indeed, in bi-consonantal clusters, more deletion than epenthesis was attested in the production of non-literate learners, but that was similar to how literate learners performed (as in finding 1) and comparisons of deletion and epenthesis rates between the two groups showed no differences (as in finding 2).

Finding 1: Non-literate learners and literate learners who are exposed to only aural input similarly simplify bi-consonantal clusters by deletion significantly more than epenthesis.

Finding 2: No L1 literacy effects are found in the production of word-initial and word-final position bi-consonantal clusters.

Therefore, the results of the production in bi-consonantal clusters disconfirm both H1 and H2.

However, the production of three-consonant clusters revealed some literacy effects, as significantly different performance was attested between the two groups (Non-literate Picture Group and Literate Picture Group). More deletion and less epenthesis were seen in the performance of non-literate learners in the production of word-initial tri-consonantal clusters, as revealed by Findings 3 and 4.

Finding 3: In tri-consonantal cluster contexts, while Non-literate Picture Group learners delete more than they epenthesise in word initial position and word final position, the Literate Picture

Group epenthesise more than they delete in word-initial position and do the reverse in word-final position.

Finding 4: Non-literate Picture Group learners delete more and epenthesise less than Literate Picture Group learners in word-initial tri-consonantal clusters.

Therefore, H1 and H2 are partially supported.

H3. Less epenthesis and more deletion will occur during learning when learners are exposed to only aural input.

This hypothesis can be tested by the results of the comparisons between the Literate Picture Group and the Literate Word Group, as only the former was exposed only to the aural input. No effect on epenthesis was observed, but more deletion occurred in the production of word-final clusters of those exposed to only aural input. Therefore, Findings 6b and 8b partially confirm H3.

Finding 6b: Exposure to only aural input causes more deletion in word-final bi-consonantal clusters, but it has no effect on epenthesis.

Finding 8b: Exposure to only aural input causes more deletion in word final tri-consonantal clusters, but it has no effect on epenthesis.

H4. More epenthesis and less deletion will occur during learning when learners are exposed to orthographic input along with aural input.

The evidence for and against this hypothesis comes from the results of comparisons between the Literate Picture Group and Literate Word Group, as only the latter group was exposed to orthographic transcription along with aural input. Higher rates of epenthesis were not attested in the production of the Literate Word Group when compared to that of the Literate Picture Group, but less deletion in word-final consonant clusters was found.

Finding 6a: Exposure to orthographic input along with aural input causes less deletion in word-final bi-consonantal clusters, but it has no effect on epenthesis.

Finding 8a: Exposure to orthographic input along with aural input causes less deletion in word-final tri-consonantal clusters, but it has no effect on epenthesis.

Therefore, against H4, no effect on epenthesis was observed in the production of learners exposed to orthographic input along with aural input.

Further evidence testing H4 comes from the comparison between deletion and epenthesis results in the performance of the same group. In light of this hypothesis, it is expected that learners who are exposed to orthographic input will rely on epenthesis more than deletion to simplify clusters. It was found that learners who were not exposed to orthographic input delete more than they epenthesise, but the difference between strategies disappeared when we looked at learners who had exposure to orthography. This was not because the rates of epenthesis became higher; it was rather an effect based on lower rates of deletion (as stated in Findings 6a and 8a above). Therefore, Findings 5 and 7 (repeated below) are further evidence disconfirming H4.

Finding 5: Exposure to orthographic along with aural input reduces deletion, which in turn decreases the difference between the use of deletion and that of epenthesis when learners simplify bi-consonantal clusters in word-initial and final-positions.

Finding 7: Exposure to orthographic along with aural input reduces deletion, which in turn decreases the difference between the use of deletion and that of epenthesis to simplify tri-consonantal clusters in word final position.

Hence, with the combination of Findings 5, 6a, 7 and 8a, H4 is disconfirmed.

H5. Learners who have already received orthographic input during learning epenthesise more when they are exposed to orthographic input during testing vs. only aural input.

Results comparing the production of Literate Word Group-test 1 and Word Group-test 2 provide evidence for and against this hypothesis. Only Word Group-test 2 was shown the orthographic transcription during testing. The results revealed no effect on epenthesis, so this hypothesis was also disconfirmed by Findings 9 and 10:

Finding 9: Exposure to orthographic transcriptions during testing does not have any effect on the production of word-initial and word-final bi-consonantal clusters.

Finding 10: Exposure to orthographic transcriptions during testing has an effect on the production of tri-consonantal clusters, as it leads to less deletion. No effect on epenthesis was found.

H6. Those with no native language literacy and only beginning English literacy will accurately produce words better than literates.

The evidence for and against this hypothesis comes from the results of comparing the accurate production between groups. Group comparisons revealed that the Non-literate Picture Group and Literate Picture Group did not differ in their performance and that the Literate Picture Group and Literate Word Group differed only in word-final two-consonant cluster production, as the latter was significantly more accurate. Hence, this hypothesis is disconfirmed.

5.9 Issues in the Acquisition of the Phonetic and Phonological Forms

Earlier in this study, in Chapter 3, section 3.4, the phonological error patterns made by children during their L1 acquisition was discussed, such as cluster reduction and consonant substitution (Ammar, 1992, 1999). This section is devoted to a qualitative analysis of the phonetic and phonological details of the errors learners made in producing the words they learned. This includes consonant substitution, vowel lengthening and other phonological aspects such as the site of the epenthetic vowel. The author will introduce the phonetic modifications made by learners in 5.9.1, the phonological aspects in 5.9.2, and sonority in 5.9.4.

5.9.1 *Phonetic Observations*

This section covers consonant substitution and vowel modification. The author will start with the results of two consonants that were subject to substitution: (/p/ and /r/). The identity of the epenthetic vowel and vowel lengthening will then be introduced.

Starting with consonant substitution, /p/ is produced as either [b] or [p]. When its position is the first member of the onset, /p/ is produced as [b], as in the following examples:

(3). 'plum' /plʌm/ → [blʌm] NL, LP, LW1 and LW2.[8]
(4). 'plane' /pleɪn/ → [bleɪn] NL, LP, LW1 and LW2

Table 5-20 shows the substituting of /p/ with [b] found for all participants.

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NL= Non-literate Picture Group
LP = Literate Picture Group
LW1 = Literate Word Group
LW2 = Literate Word Group post-test 2

Table 5-20: Substitution of /p/ with [b] by all groups two-consonant clusters

Words / Groups	**Two-consonant Clusters**	
	plum	plane
	[blʌm]	[bleɪn]
Non-literate	20/20 (100%)	19/20 (95%)
Literate Picture Group	20/20 (100%)	20/20 (100%)
Literate Word Group	20/20 (100%)	19/20 (95%)
Literate Word Group-test 2	20/20 (100%)	20/20 (100%)
Total	(80/80)	(78/80)[9]
Cell shows number of times of substituting /p/ with [b] / number of words learnt		

However, /p/ is realised as [p] in any other position including the second member in the onset, as in:

(5). 'spray' /spɹeɪ/ → (a): [spɾeɪ]; (b) [speɪ]; (c) [spi.ɾeɪ]

(6). 'spring' /spɹɪŋ/ → (a) [spɾɪŋ]; (b) [spi.ɾɪŋ]

In addition to this, /p/ is realised as [p] when it occurs in the coda position as either the first or second member, as in:

[9] The missing number is for the participant who did not produce the word, because they did not remember the word(s).

(7). 'spray' /spɹeɪ/ → (a) [sip.ɾeɪ]; (b) [ʔisp.ɾeɪ]

(8). 'spring' /spɹɪŋ/ → (a) [sip.ɾɪŋ], (b) [ʔisp.ɾɪŋ]

Table 5-21 shows the number of times participants produced the word ‘spray’ and Table 5-22 shows the production of the word ‘spring’.

Table 5-21: /p/ → [p] in the word 'spray' by all groups

Groups	Spray				
	Onset			coda	
	[s**p**ɾeɪ]	[s**p**eɪ]	[s**pi.**ɾeɪ]	[sip.ɾeɪ]	[ʔis**p.**ɾeɪ]
Non-literate Picture Group	10/19 (53%)	7/19 (37%)	1/19 (5%)	0/19 (0%)	1/19 (5%)
Literate Picture Group	13/20 (65%)	2/20 (10%)	1/20 (5%)	1/20 (5%)	3/20 (15%)
Literate Word Group	7/20 (35%)	3/20 (15%)	1/20 (5%)	7/20 (35%)	2/20 (10%)
Literate Word Group -test 2	4/20 (20%)	1/20 (5%)	2/20 (10%)	12/20 (60%)	1/20 (5%)

*Cells show number of times of production / number of words learnt

Table 5-22: /p/ → [p] in the word 'spring' by all groups

Groups	Spring				
	Onset			coda	
	[s**p**ɾɪŋ]	[sp**i**.ɾɪŋ]	[spɪŋ]	[si**p.**ɾɪŋ]	[ʔis**p.**ɾɪŋ]
Non-literate Picture Group	9/17 (53%)	1/17 (6%)	7/17 (41%)	0/17 (0%)	0/17 (0%)
Literate Picture Group	8/17 (46%)	4/17 (24%)	1/17 (6%)	2/17 (12%)	2/17 (12%)
Literate Word Group	7/20 (35%)	2/20 (10%)	1/20 (5%)	7/20 (35%)	3/20 (15%)
Literate Word Group -test 2	5/20 (25%)	2/20 (10%)	0/20 (0%)	10/20 (50%)	(3/20) (15%)
*Cells show number of times of production / number of words learnt					

Another consonant phoneme which is subject to substitution is [r] when it is the third member of the onset position, as in:[10]

(9). 'screen' /skɹiːn/ → [skwiːn] NL 2, 3, 4, 6 and 12. LP 1, 3 and 14

(10). 'street' /stɹiːt/ → [stwiːt] NL 6 and 12. LP 1, 3, 10 and 14

Table 5-23 below shows the number of times of substituting [r] with [w] found for all four groups.

[10] Participants of all groups produced /r/ with an Arabic-accent [ɾ] (see Chapter 2, section 2.1.2).

Table 5-23: Substituting /r/ with [w]

	screen	street
	[sk**w**iːn]	[st**w**iːt]
Non-literate Picture Group	(5/20) 25%	(2/18) 11%
Literate Picture Group	(3/18) 17%	(4/17) 23%
Literate Word Group	(0/20)	(0/20)
Literate Word Group-post-test 2	(0/20)	(0/20)
*Cells show instances of production / number of words learnt		

From the table above it can be seen that substituting /r/ for [w] is a strategy used by participants who were exposed to the aural input when faced with three-consonant clusters in words like 'screen' /skɹiːn/ → [skwiːn]. This substitution is produced seven times by the Non-literate Picture Group and by an equal number in the Literate Picture Group. No such substitution for /r/ is made by those who were exposed to the orthographic input.

The epenthetic vowel [i] was inserted to break up consonant clusters when participants faced a syllable structure more complex than that of their L1. No other epenthetic vowels were observed in participants' production. The identity of [**i**] is introduced in section 2.3.6, Chapter 2, and will be further discussed in Chapter 6 (section 5.9.1). Vowels were subject to substitution in only two-consonant words of the 26 targeted words. In 'third' /θəɹd/ the central short vowel /ə/ is fronted and lengthened into [**ɛ**ː] to be [θ**ɛ**ːɾd]. This substitution was produced twice by the Non-literate Picture Group and four times by the Literate Picture Group. The Literate Word Group and Literate Word Group post-test 2 had the same number as the Non-literate Group. Similarly, the high front short vowel [**i**] in 'fifth' /fɪfθ/ is centralised and lowered to be [f**aɪ**fθ]. Only learners who were exposed to the orthographic input along with the aural input 'Literate Word Group and Literate Word Group -test 2' produced [**i**] as [**aɪ**] three times each.

After having looked briefly at the main phonetic observations, the author will now turn to the phonological strategies of note that Arabic-speaking learners used when dealing with a new syllable structure.

5.9.2 *Phonological Observations: Two-consonant Clusters*

In the onset position in two-consonant clusters, all groups of participants who deleted consonants in this particular position omitted the second member of the onset in the word 'frog', / fɹaːɡ/ to be [faːg]. To remind the reader of the targeted words with two-consonant clusters, the words are repeated in Table 5-24, which shows instances of deletion by all groups in two-consonant word-initial clusters.

Table 5-24: Number of times of deletion in two-consonant onset by all groups

	Two-consonant clusters onset						
Words	snake	frog	three	sky	plane	quail	plum
Trans.	/sneɪk/	[faːg]	/θɹriː/	/skʌɪ/	/pleɪn/	/kweɪl/	/plʌm/
Non-literate Picture Group	0	12/20 (60%)	0	0	0	0	0
Literate Picture Group	0	10/20 (50%)	0	0	0	0	0
Literate Word Group	0	(4/20) (20%)	0	0	0	0	0
Literate Word Group-post-test 2	0	(2/20) (10%)	0	0	0	0	0

The table above shows that none of the participants in all groups deleted any of the consonants in two-consonant clusters word-initially except in the word ‘frog’, /fɹaːg/→ [faːg], where the highest number of deletions was done by the Non-literate Picture Group.

Moving to deletion in two-consonant clusters word-final, targeted words with two-consonant clusters in coda position are shown in Table 5-25 below; recall that participants were exposed to a rhotic (American) accent. The reader is referred to Appendix F for the transcription of participants’ production. [11]

Table 5-25: Two-consonant clusters coda

CC Coda									
Words	bird	desk	six	shelf	horse	second	third	fourth	fifth
Trans.	/bəɹd/	/dɛsk/	/siks/	/ʃɛlf/	/hɔːɹs/	/sekənd/	/θɝɹd/	/fɔːɹθ/	/fɪfθ/

Participants who deleted in this position to avoid consonant clusters deleted at syllable margins in all targeted words (except in ‘shelf’ /ʃɛlf/, ‘bird’ /bərd/ and ‘second’ /sekənd/). The figures for deletion are shown in Table 5-26 and then the strategies used will be explained.

[11] Participants’ input consisted of General American.

Table 5-26: Production of ‘shelf’ /ʃɛlf/ and ‘second’/sekənd/ by all groups

Words	bird	shelf	Second	
Trans.	[bəd]	[ʃɛf]	[sekəd]	[sekən]
Non-literate Picture Group	3/16 (19%)	8/19 (42%)	3/20 (15%)	16/20 (80%)
Literate Picture Group	3/19 (16%)	7/19 (37%)	5/19 (26%)	11/19 (58%)
Literate Word Group	0/20 0%	0/19 (0%)	0/20 (0%)	1/20 (5%)
Literate Word Group-post-test 2	0/20 0%	0/19 (0%)	0/20 (0%)	0/20 (0%)

In words ‘bird’ [bəd] and ‘shelf’ [ʃɛf], participants did not delete the final consonant ([d] in [bərd] and [f] in [ʃɛlf], but they omitted the first member of the consonant cluster ([r] in [bərd] and [l] in [ʃɛlf].

In the word ‘second’ /sekənd/, a few participants deleted the first member [n] resulting in [sekəd] while the majority deleted the final consonant [d] resulting in [sekən]. By looking at participants’ production of ‘second’, more participants who were exposed to the aural input (95% of Non-literate Picture Group and 84% of Literate Picture Group) used deletion of either the first or the second consonant to avoid consonant clusters at syllable margins.

In other targeted words like ‘third’ /θəɹd/, ‘fourth’/fɔːɹθ/ and ‘fifth’ /fɪfθ/, participants who used deletion to avoid a complex syllable deleted only the second member of the coda to be [θɝr], [fɔːr] and [fɪf].

In the rest of the targeted words with two-consonant cluster word-final (‘horse’ ‘desk’ and ‘six’), no deletion was produced by the participants in all groups.

After looking at the general phonological observations in two-consonant clusters, the author will now turn to three-consonant clusters.

5.9.3 *Phonological Observations: Three-consonant Clusters*

This section presents an overview of the phonological observations of the strategies used for simplifying complex onsets and codas in three-consonant clusters. It will start with generalisations related to the production of tri-consonantal clusters in the onset where deletion will be introduced first, followed by epenthesis in the same position. Then, participants' production of three-consonants in the coda position will be presented.

Regarding tri-consonantal cluster onsets, we saw earlier in Chapter 4 (section 4.5.1), Table 4-4, that the targeted words were 'spray', 'screen', 'street', 'square', and 'spring'. In terms of deletion, participants omitted the third member of the onset cluster in three of these words, namely 'spray', 'screen', and 'spring', as follows:

(11). 'spray' /spɹeɪ/ → [speɪ]
(12). 'screen' /skɹiːn/→ [skiːn]
(13). 'spring' /spɹɪŋ/ →[spɪŋ]

Participants did not delete any of the consonants in 'street' and 'square'.[12]

In terms of epenthesis in word-initial position, participants inserted an epenthetic vowel in three different positions: (1) before the first member of the consonant cluster (/CCC/ → [**ʔV**C.C])[13] as in 'square' [**ʔi**sk.wer] and 'street' [**ʔi**st.riːt] where the glottal stop is inserted before the consonant cluster, (2) after the first member of the three-consonant cluster as in 'screen' [sik.ɾiːn] and 'square' [sik.weɾ] [C**V**C.C], and (3) after the second member of the consonant cluster as in 'screen' [sk**i**.riːn] and 'spring' [sp**i**.rɪŋ] [CC**V**.C]. Table 5-27 shows the number of times the three strategies were used.

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[12]Participants did epenthesise in these three words. This paragraph is meant to show the results of deletion.
[13]**ʔ** Represents an epenthetic glottal stop.
[**V**] Represents the epenthetic vowel.
[.] Stands for syllable boundary.

Table 5-27: Epenthesis in three-consonant cluster onsets

Epenthesis	[C**V**C.C]	[**ʔV**CC.C]	[CC**V**.C]
Non-literate Picture Group	0/9 (0%)	3/9 (33%)	6/9 (67%)
Literate Picture Group	12/33 (36%)	14/33 (43%)	7/33 (21%)
Literate Word Group	37/50 (74%)	11/50 (22%)	2/50 (4%)
Literate Word Group-test 2	51/62 (82%)	7/62 (11%)	4/62 (7%)
*Cells show the number of times the strategy was used / times of epenthesis			

It is worth mentioning that the Non-literate Picture Group did not epenthesise after the first member of the consonant cluster mentioned in (1), rather they used (2) and (3).

Moving on to the results of deletion which occurred in three-consonant clusters in the coda position, the author will firstly remind the reader that the targeted words included 'desks', 'sixth', 'text', 'first', and 'gifts' (see Table 4-4 and Appendix F for the transcription of participants' production). Participants preferred to delete the third consonant in clusters in most of the targeted words, as in 'desks' [desk], 'sixth' [siks], 'text' [tɛks], 'first' [fərs], and 'gifts' [gɪft].

Remarkably, as shown in Table 5-28 below, participants who were only exposed to the aural input deleted the second member of the consonant cluster in the word 'gifts' [gɪfs] more than those who were exposed to the orthographic input. Table 5-28 shows the number of times participants produced the word 'gifts'.

Table 5-28: Deletion in the word 'gifts'

Number of Times of Deletion	gifts /gɪfts/			
	[gɪft]	[gɪfs]	[gɪfts]	[gɪf]
Non-literate Picture Group	6/20 (30%)	7/20 (35%)	6/20 (30%)	1/20 (5%)
Literate Picture Group	7/19 (37%)	5/19 (26%)	7/19 (37%)	0/19 (0%)
Literate Word Group	11/20 (55%)	0/20 (0%)	8/20 (40%)	0/20 (0%)
Literate Word Group-test 2	8/20 (40%)	0/20 (0%)	11/20 (55%)	0/20 (0%)
*Cells show the number of times of production / number of words learnt				

In terms of epenthesis in three-consonant clusters in the coda position, Non-literate Learners epenthesised only when they faced three-consonant clusters in the word ‘first’ /fəɹst/, where they inserted an epenthetic vowel after the first member of the consonant in clusters to be [fə.rɪst].or [fə.**ri**s]. No epenthesis in the other list of words was produced (see Table 5-4).

This strategy was not only used by the Non-literate Picture Group, as other groups also inserted an epenthetic vowel in different environments: after the first member of the consonant cluster in two words (‘text’ [tɛ.kist] and ‘sixth’ [sɪ.kisθ]) and after the second member of the consonant cluster (‘desks’ [dɛs.kis]). No participant syllabified the word ‘desks’ using the strategy used with ‘text’. A possible explanation for such clustering is that the first word [dɛsks] is fricative-stop-fricative and the second word [tɛkst] is stop-fricative-stop. It could be due to markedness: that the first one results in word-final fricatives which are less marked while the second one results in word-final stops which are more marked.

After having looked at the phonetic and phonological observations, the next section will show if there is a relation between sonority and participants’ production of the consonant clusters.

5.9.4 ***Sonority***

As far as sonority among consonant clusters is concerned, the data reveals that there was no pattern related to sonority. In the tokens where sonority distance was preserved (i.e. a segment with a higher sonority value was closer to the nucleus, e.g. *plum*), the participants (of all categories) did not produce patterns such as metathesis of the two segments of the relevant consonant clusters or epenthesis through inserting an epenthetic vowel between the two segments. Likewise, in the tokens where sonority was not preserved (i.e. a segment with a higher sonorous value was farther from the nucleus, e.g. *desks*), nothing could be noted with respect to sonority. The general tendency to have the third segment deleted is actually related to deletion in complex consonant clusters ‘more marked syllables’, something that is also observed with respect to triplets where sonority is persevered.

5.10 **Chapter Summary**

This chapter revealed the results of the present study. It started by presenting the quantitative results of epenthesis and deletion in all types of consonant clusters in both positions. Comparisons of the results of Arabic-speaking learners’ acquisition of two and three-consonant clusters were presented in section 5.4 to 5.8. Section 5.9 presented the phonetic and phonological observations. The following chapter, Chapter 6, discusses the results.

Chapter 6. Discussion

6.1 Introduction

This chapter discusses the results of the word-learning experiment introduced in Chapter 4 and presented in Chapter 5 that investigated the role of orthographic exposure in adult beginners' second language word learning, along with the role of L1 literacy.

In the following subsections, the author will firstly discuss the role of L1 literacy in L2 acquisition by comparing the production of the Non-literate Picture Group with the Literate Picture Group in section 6.1.1. Then, section 6.1.2 will discuss the results of the role of orthographic exposure during L2 learning by comparing the Literate Picture Group with the Literate Word Group, since only the latter was exposed to the orthographic input. Section 6.1.3 discusses the effects of seeing words written during testing by comparing the results of the Literate Word Group in two conditions (i.e. test 1 and test 2).

As previously mentioned, this study focuses mainly on the acquisition of English words containing consonant clusters syllable margins (onset and coda) which are not available in the participants' L1. These syllable margins are considered marked (Belvins, 1995). Hence, section 6.1.4 will discuss certain learning issues, such as the difficulty of acquiring three-consonant clusters and the accuracy rates in learners' production. In this section, two hypotheses introduced earlier in Chapter 3 (sections 3.1.2 and 3.1.3) will be applied to the results of this study. The first one is the Contrastive Analysis Hypothesis (CAH) which suggests that difficulties L2 learners encounter during L2 acquisition are due to the differences between L1 and L2 and thus, any difference leads to difficulty (Lado, 1957). The second hypothesis is the Markedness Differential Hypothesis (MDH) which takes into consideration a form's degree of markedness; i.e. when a form in L2 is more marked than in a learner's L1, the learner is expected to face difficulty (Eckman, 1977).

Section 6.3 highlights the differences among groups regarding the strategies used; i.e. the place of the epenthetic vowel and which member of the consonant cluster is deleted. Hence, this section is sub-divided into deletion and epenthesis.

6.1.1 *No L1 Literacy vs. L1 Literacy*

The aim of this study was to investigate the role of L1 literacy in beginners' acquisition of new phonological forms. To achieve this aim, 20 non-literate Najdi Arabic speakers (Non-literate

Picture Group) and an equal number of literate Najdi Arabic speakers (Literate Picture Group) were exposed to only aural input. The question posed was 'what role does literacy play when acquiring a new syllable structure?' It was also hypothesised that:

H1. Those with no native language literacy and only beginning English literacy will epenthesise less than literates who receive only aural input.

H2. Those with no native language literacy and only beginning English literacy will delete more than literates who receive only aural input.

The findings of this study support these hypotheses but only in the tri-consonantal context. Non-literate learners relied on deletion significantly more than epenthesis when faced with a complex structure more marked than in their L1 in onset and coda position ($Z= -3.745$, $p= .000$).[14] In onset position, as an example, they deleted more and epenthesised less (23.8% compared with 9.89% $Z= -1.612$, $p= .107$) than the Literate Picture Group in onset position tri-consonant clusters (9.89% compared with 35.87% $U = 112$, $Z = -2.54$, $p = .01$).

In two-consonant clusters, a comparison of the two groups' production did not reveal any effect of L1 literacy. Both groups equally relied on deletion significantly more than epenthesis. Two possible explanations for these results can be suggested. Firstly, clustering of two consonants is permitted in Najdi Arabic in both positions (Abboud, 1977; Ingham, 1994; Alezets, 2007). In onset position, participants of both groups produced the clusters most of the time. Thus, results of this study have shown that deletion was used only with the cluster/fɹ/ in 'frog' where the second member of the onset cluster was deleted 'frog' [faːg] and there was no epenthesis by either groups. Secondly, in the coda position, instead of deletion, there was some vowel diphthongisation, for example in /θɝɹd/ → [θɛɪɹd] 'third' (1.18% by Non-literate Picture Group and 3.45% by Literate Picture Group). Participants also did not use an epenthetic vowel to break up the two-consonant clusters. Hence, the answer to the question 'what role does literacy play when acquiring a new syllable structure?' is that when participants were exposed to the aural input, those who had no prior knowledge of literacy in their L1 relied on deletion in the more marked syllables that are not found in their L1 more than those who were formally educated. In other words, a lack of L1 literacy coupled with markedness led to more deletion and less epenthesis. Recalling children's phonological error patterns mentioned earlier in Chapter 3, section 3.4, it seems that those with no native language literacy use similar strategies to those

[14] The place of the epenthetic vowel used by all groups will be discussed in section 6.3.

used by children, whereby children, cross linguistically, omit consonants rather than epenthesise. Findings of this study are similar to what Ammar (1999) found when she targeted 100 monosyllabic words containing CVCC syllable structure to study the error patterns of 51 typically developing Egyptian-Arabic speaking children. Her findings were that young L1 learners depended on deletion rather than epenthesis, despite the fact that the children would already have been exposed to the productive process of epenthesis in Arabic. In Ammar's study, the children deleted the whole cluster as in (/daʔn/ → [da] ' chin', omitted one of the consonants in CC clusters as in /ʔird/ → [ʔir] 'monkey', or omitted one of the consonants and lengthened the vowel as in /kalb/ → [ka:b] 'dog'. Both Ammar's findings and the findings of the present study echo what Weinberger (1987) and Young-Scholten et al. (1999) mention about young L1 learners: that in the early stages of their L1 acquisition, cross-linguistically, they delete consonants rather than add new syllables through epenthesis.

In brief, despite the fact that L1 literacy skills help support development of literacy skills in L2 (Cummins, 1999; Bialystok, 2002; Bigelow and Tarone, 2004), the findings of the present study indicate that if the syllable structure is more marked than learners' L1, and if learners are exposed only to the aural/phonological input, learners with no prior knowledge of L1 literacy epenthesise less and delete more, while participants with satisfactory L1 literacy epenthesise more and delete less. That is, they behave like young children. This is not unlike what has been claimed with respect to their early reading, as argued by Young-Scholten and Strom (2006).

6.1.2 *Aural Input vs. Orthographic Input*

Following Young-Scholten et al. (1999), Bassetti (2007, 2009), and Rafat (2011), another aim of the current study was to investigate the role of orthographic input on L2 acquisition. Two hypotheses were presented in Chapter 4 (section 4.2) and are repeated below:

- H3. Less epenthesis and more deletion will occur during learning when learners are exposed to only aural input.
- H4. More epenthesis and less deletion will occur during learning when learners are exposed to orthographic input along with aural input.

To investigate these hypotheses, the results obtained regarding participants who were exposed to the aural input (Literate Picture Group) were compared with those who were exposed to the orthographic input along with aural input (Literate Word Group), as only the latter were shown the written forms of the words during learning.

To begin with, in the light of H3, less epenthesis was predicted in the performance of the Literate Picture Group, since they did not have access to the orthographic representations. Accordingly, it was expected that they would rely more on deletion.

In light of H4, it was hypothesised that the Literate Word Group would rely more on epenthesis and less on deletion to simplify consonant clusters, as they were introduced to the English alphabet and they were exposed to written forms of the words to be learned. Findings of two-consonant clusters (Chapter 5, section 5.6) showed no epenthesis in onset position and low rates of epenthesis in the coda, as the rate of epenthesis word-finally was 3.4% for both groups. Hence, exposure to orthographic input, in a two-consonant context, did not show a significant difference and did not have the predicted effect on the occurrence of epenthesis.

Similarly, in tri-consonantal clusters, there were higher rates of epenthesis by both groups in onset position (35.87% by Literate Picture Group compared with 50% by Literate Word Group), as rates of epenthesis were lower in coda position (15.79% by Literate Picture Group compared with 27% by Literate Word Group). When comparing OI with AI, it is clear that the Literate Word Group epenthesised more than the Literate Picture Group by 14 percentage points, but this did not reveal a significant difference. Similar to the results of two-consonant clusters, the predicted effect of frequency of epenthesis was not achieved in three-consonant clusters. As for deletion, it was further predicted that those who were exposed to only auditory input would rely more on deletion, while those who were exposed to orthographic input along with aural input would delete less. In the two-consonant context, exposure to only aural input showed an effect on deletion word-finally, as aural participants omitted consonants (20.11%) significantly more than they epenthesised (3.4%). This effect was even stronger when they were faced with tri-consonant clusters in coda position (51.58% deletion compared with 15.79% epenthesis).

On the other hand, the difference between epenthesis and deletion decreased when learners were exposed to orthographic input. This was not because the rates of epenthesis became higher; it was rather an effect based on lower rates of deletion (see Chapter 5, section 5.6). Although these findings echo those of earlier studies (Young-Scholten et al., 1999; Bassetti, 2007, 2009; Bassetti and Atkinson, 2015) whose authors mention that deletion is the preference for most post-puberty L2 learners when they are exposed only to aural input when dealing with complex clusters, both H3 and H4 were disconfirmed, since exposure to orthographic input had no effect on epenthesis.

The total number of words containing tri-consonant clusters learned by the Literate Word Group was found to be statistically higher than the total learned by those who were only exposed to aural input. So it was an OI rather than a literacy effect, and it was connected to cluster length (see Chapter 5, section 5.2). Hence, this means that the presence of orthography facilitated L2 learning. These findings are supported by those of Escudero et al. (2008), Showalter and Hayes-Harb (2013), Rafat (2015), and Escurdero (2015), who found that the availability of written representations aided L2 learning. Therefore, both H3 and H4 were not borne out.

These findings not only examine H3 and H4, they also answer the second question of this study which asks how seeing words written in L2 during learning can influence learners' acquisition of English syllable structure. Results indicated that exposure to orthography led the 20 Najdi Arabic beginners in English to eliminate the difference between the two strategies used for simplifying marked syllable structure, while an absence of the written forms during learning led to more deletion (Young-Scholten et al., 1999; Bassetti, 2009).

In sum, this study is further evidence that exposure to orthographic input can facilitate L2 acquisition. The presence of orthographic input did not only eliminate the difference between both simplification strategies used but, when the syllable was more marked than participants' L1 (i.e. three-consonant clusters), orthography aided learners in remembering words more than those who were only exposed to aural input. The absence of orthography resulted in more deletion and less epenthesis.

6.1.3 *Orthographic Input during Testing*

It has also been asked whether there is an additional effect of seeing the written forms of words during testing. To answer this question, it was hypothesised that seeing words during testing would lead to more epenthesis. One possible way to investigate orthography exposure during testing was to expose participants of the Literate Word Group to the orthographic transcription during testing. The results of their performance before and after exposure (test 1 and test 2) were compared.

In the two-consonant context, results of both tests did not reveal any significant effect on the production of word-initial and word-final bi-consonantal clusters. In both tests, participants performed similarly, with very low rates of both simplification strategies (see Chapter 5, section 5.7). Hence, the predicted frequencies of epenthesis were not found.

However, in terms of deletion in tri-consonantal clusters, the presence of orthography during testing had a significant effect, as it led to less deletion. In terms of epenthesis, in both tests the group (which was the same group, tested twice) relied significantly more on epenthesis rather than deletion. Although the Literate Word Group test 1, in onset position as an example, epenthesised 50% while the Literate Word Group test 2 epenthesised 62%, these differences were not significant (Z = -1.470, p = .110). That is, the availability of OI during testing did not aid Najdi Arabic speakers to perform better when producing English syllables. These higher rates of epenthesis compared to the lower rates of deletion might be because of the memory-enhancing effect of exposure to orthography during L2 learning and during testing (Young-Scholten, 2002).

Exposure to orthography during testing did not cause significant epenthesis differences in the performance of this group in the two tests they took. So, this result disconfirms the proposed hypothesis which predicted that exposure to OI during testing would lead to more epenthesis. In addition, these findings answer the research question which asked 'is there an effect of OI during testing?' This study's findings reveal that exposure to OI during testing led to less deletion. A possible explanation for this is that when participants saw the consonants during testing, this helped them to produce them (Young-Scholten et al., 1999; Bassetti, 2009).

6.1.4 *Learning Issues*

Najdi Arabic speakers, when acquiring English syllable structure, were found to produce words with two-consonant clusters with less difficulty than words with three-consonant clusters. For example, none of the participants used an epenthetic vowel to break up consonants in two-member clusters, while higher rates of epenthesis were seen in three-consonant clusters in both positions. Recalling the syllable structure of Najdi Arabic presented in Chapter 2 (section 2.2), onsetless syllables are not permitted in this dialect, as the syllable has to start with at least a consonant in all Najdi syllable patterns. Additionally, onsets can have more than one consonant but only word-initially (Abboud 1979; Ingham, 1994). Both Abboud (1979) and Alezets (2007) agree that a bi-consonantal cluster in NA is permissible in syllable margins, including in the coda in such examples as [**kr**a:ʕ] 'leg' and [ʃa**rg**] 'east'. According to Lado's (1957) Contrastive Analysis Hypothesis (CAH) and the revisions of Eckman's (1977) Markedness Differential Hypothesis (MDH), Najdi Arabic speakers would be predicted to have fewer difficulties in the production of bi-consonant clusters at word-edges. However, the learner is predicted to face difficulty if the target language differs from the native language and has more marked forms than the learner's L1. In Chapter 2 (section 2.3.5) we saw that Najdi Arabic also violates the Sonority Sequencing Principle word-initially in such examples as [**ħsˤ**aːn] 'horse'. This violation is considered by MDH as a more marked syllable structure than the syllable structure of the target language. Due to this, MDH would also predict that Najdi Arabic L2 English learners would not face difficulty when learning English words containing two-consonant clusters word-initially. The results of this study support these predictions, since none of the participants broke up the two-consonant clusters in syllable margins. Where the syllable structure is more marked than in a learner's L1, as with the case of tri-consonant clusters in English for Najdi Arabic speakers, the results of the present study confirm the above predictions (see Chapter 5, section 5.3, Table 5-2, where learners of all groups were more accurate in producing two-consonant clusters than three-consonant clusters).

Broselow's (1984) Syllable Structure Transfer Hypothesis can also account for why Najdi Arabic-speaking learners have more difficulty when acquiring a syllable structure more complex than that of their L1. She suggests that learners make errors by changing the non-permitted form of TL to those that are allowed in their native language. Findings of the present study are a further confirmation of Broselow's (1983) findings in her study on Cairene and Iraqi Arabic speakers' L2 English regarding transferring allowed syllable structures from their L1 to their L2 when simplifying the syllable structure by inserting the vowel [i]. The present study differs from Broselow's, however, as participants have used other simplification strategies due to the teaching method used to investigate the purpose of this study (simplification strategies will be discussed in more detail in section 6.2 below).

As the comparisons in this section are cross-group differences/similarities, it is worth mentioning that a lack of L1 literacy led to significantly more deletion, while exposure to orthographic input during learning/testing resulted in more epenthesis. That is to say, when learners faced a more marked syllable structure than that of their L1, those who were non-literate simplified complex syllables with the use of the strategy used by L1 learners, while those who were literate in their L1 and exposed to the written representations during L2 learning retained what they visually saw during learning (Young-Scholten et al., 1999). Despite this, cross-group comparisons did not reveal differences in learners' accuracy in producing clusters of both types and positions, except for one case in which the Literate Word Group produced word-final two-consonant clusters significantly more accurately than the Literate Picture Group. This finding disconfirms the proposed hypothesis which predicted that those with no native language literacy and only beginner English literacy would accurately produce words better than literates (H6). Results of this study are supported by what Bigelow and Tarone (2004) suggested in that L1 literacy facilitates L2 literacy.

To sum up, Najdi Arabic speakers seem to have less difficulty in the acquisition of English bi-consonant clusters in both word-initial positions (onset and coda). When the syllable structure is more complex than that of their L1, they modify the syllable structure by transferring allowable syllable structure from their L1.

In the remainder of this chapter, the author will discuss some related phonotactic and phonological issues that arose when analysing the data.

6.2 Acquisition of the Phonetic and Phonological Forms

This section presents issues related to the acquisition of the phonetic and phonology of L2 English by Najdi Arabic speakers. Firstly, section 6.2.1 will discuss learning issues on the segmental level, such as the identity of the epenthetic vowel used and consonant(s) substitution. The second sub-section will discuss complex syllable simplification strategies used (deletion and epenthesis in 6.3).

6.2.1 *Phonetic Observations*

At the segmental level, three phonotactic patterns could be observed for participants in the present study. Two patterns could be generalised for all participants and the third pattern was unique to those who were exposed only to the aural/phonological input. In general, participants of all groups used the epenthetic vowel [**i**] to break up consonant clusters, and they all produced /p/ variably, as either [p] or [b] depending on its position in the word. The third pattern was found for participants of auditory only exposure who substituted /r/ for [w].

In general, participants used the epenthetic vowel [i] as a default vowel to break up consonant clusters more difficult than those existing in their L1. Recalling the vowel inventory of NA in Chapter 2 (section 2.1.3), NA has eight vowels; three long vowels: open [a:], close back [u:] and close front [i:]; and their short counterparts [a], [u] and [i], as NA has two more long vowels with no counterpart, [o:] and [e:] (Abboud, 1979; Al-Sweel, 1987, 1990; Ingham, 1994; Alotaibi and Hussein, 2010). Najdi Arabic speakers seem to prefer using the close front vowel [i] as a repair strategy to input which does not meet their L1's structural requirements. Earlier in this study, evidence was provided that NA speakers generally use the epenthetic vowel [i] in both positions (onset and coda) of a word in such examples as /staʕ.mal/ → [ʔ**i**s.taʕ.mal] 'he consumed' and in coda as in /t̠ˤifl/ → [t̠ˤi.f**i**l] 'child'. Thus, during the learning of English words, all NA L2 English learners who epenthesised used the default epenthetic vowel when faced with complex structure in words, such as in [s**i**p.ɾeɪ] and [sɪ.kisθ] (see Appendix F for more examples).

Where participants of all groups pronounced /p/ as either [b] or [p] (see Chapter 5, section 5.9.1), it was pointed out that /p/ is produced as [b] when it is the first member of the onset, as in these examples where it is followed by an /l/:

(14). /**p**lʌm/ → [**b**lʌm] 'plum' and /**p**leɪn/ → [**b**leɪn] 'plane'

(see Table 5-20 for times of substitution).

The findings of this study echo those of Flege (1980), who suggests that L2 learners depend on their knowledge of L1 by substituting non-existing sounds of L2 to the closest counterpart of L1. Likewise, Buali (2010) found that Gulf Arabic speakers of English as L2 produce /p/ as [b] if it occurs in the onset.

Yet, /p/ is pronounced as [p] in any other position in the study data, including the second member in the onset. Consider the following examples:

(15). 'spray' /spɹeɪ/ → (a) [spreɪ]; (b) [speɪ]; (c) [spi.ɾeɪ]

or when it occurs in coda position, as in:

(16). /spɹeɪ/ → (a) [sip.reɪ]; (b) [ʔisp.reɪ] 'spray'

(for more examples, see examples (5) to (8), Chapter 5, section 5.9.1).

It is worth mentioning that although NA lacks the voiceless bilabial plosive /p/, the Principle of Maximal Contrast (Jakobson, 1941) suggests that when a language has the most marked of the hierarchy /b/, the least marked of its counterpart /p/ will also be a part of the set (see Chapter 2, section 2.1.2).

The reason why NA speakers produce /p/ as [p] in any position except if it occurs as the first member of the onset could be because of the devoicing process noted by Watson (2002) and Salem (2014). According to these authors, devoicing occurs in two positions. The first one is if the voiced plosive is followed by a voiceless consonant, as in /kata**<u>b</u>**t/ → [ka.ta**<u>p</u>**t] ‘I wrote’. Watson (2002) adds that it is the case if /p/ is devoiced when it becomes word- or clitic-final, as in /ba:**b**.kabi:r/ → [ba:**p**.kabir] ‘a big door’, for example. These assumptions could support the findings of this study, since /p/ is produced as [p] when it is in the coda position as in example (16) above. For realisation of /p/ mentioned in (15), since the phonological environment following the phoneme /p/ varied, a possible generalisation is that /p/ is produced as [p] if it is proceeded by [s]. However, /p/ is realised as an allophone of /b/ in two positions: if it occurs in onset position following [s] or if it is in the coda.

The third pattern observed is /r/ substitution. This phoneme was substituted to [w] by participants who were exposed to only aural input. The consonant ‘r’ does exist in NA but as either a tap or trill, where it is tap if single as in [baɾa] ‘he sharpened’ and trill when it is a geminate as in ['barra:] ‘outside’ (Shaheen, 1979; Khattab, 2002). However, this phoneme was substituted not with the Arabic rhotic but when it occurred as the third member of an onset, for example in /skɹi:n/→ [sk**w**i:n] ‘screen’ and in the word /stɾi:t/→ [st**w**i:t] ‘street’. As seen in section 5.9.1, Chapter 5, substitution of this segment was produced seven times by participants in the Non-literate Picture Group and seven times by participants in the Literate Picture Group. There was no such substitution for /r/ by those who were provided with orthographic representations. Hence, it would be worth recalling that this sort of substitution is used during the acquisition of L1, where young L1 learners substitute one phoneme for another (Dodd, et al., 2006). Similarly, Ammar (1992) mentions that among seven typical Arabic-speaking children’s speech errors is /r/ substitution. Three possible explanations for why the Picture Group participants in the present study did so can be offered. Firstly, the substitution of /r/ with [w] by our NA speakers could be due to the fact that /r/ occurred in a syllable structure that was more marked than that of their L1, which made it more difficult for them to produce this consonant. Secondly, this could be due to the absence of the written forms of the words, which led them to use strategies normally found among children not yet literate. Thirdly, the phoneme /r/ is frequently substituted with [w], according to Leopold (1970) and Khattab (2002), due to the labiality of both phonemes. Hence, participants of this study produced /r/ as [w] similar to Leopold’s English-German bilingual daughter who frequently made this substitution. Based on this, literacy as a variable is assumed not to affect /r/ substitution, since those who were literates also substituted it similar to the non-literates. However, to the best of the author’s knowledge, there is no previous research that has dealt with literacy as a variable during L2 phonetic or phonological acquisition. Thus, further research in this field is highly recommended.

Overall, three patterns can be observed: the epenthetic vowel used, /p/ production, and /r/ substitution. NA participants used [i] as a default epenthetic vowel to break up consonant clusters in both positions (onset and coda). In NA dialect, [p] emerges as an allophone of /b/ if it occurs word-final or if it is preceded by [s]. /r/ was substituted for /w/ only by participants who were not provided with orthographic input and only when this consonant occurred as the third member of an onset cluster.

The phonological modification strategies used by participants will now be discussed in the following section.

6.3 Phonological Modification

As discussed earlier in this chapter (sections 6.1.1 to 6.1.3), Najdi Arabic speakers relied on two modification strategies during learning words with English syllable structure. They depended either on deletion or on epenthesis to simplify structure that did not conform to their native syllable structure. Previously, we saw in Chapter 5 (sections 5.9.2 and 5.9.3) that how these modification strategies were used varied among participants' groups; i.e. the place where an epenthetic vowel was inserted and which segment of the consonant cluster was deleted. Here, the author will first discuss deletion in two- and three-consonant clusters in onset and coda and will then discuss epenthesis in these clusters.

Deletion

In terms of deletion in onset, in bi-consonant clusters there was no deletion except in the word /fɹaːg/ → [faːg] 'frog'. This deletion occurred among participants who were exposed to aural input only (60% of Non-literate Picture Group and 50 % of Literate Picture Group). In terms of tri-consonantal clusters, participants of all groups omitted the third segment, as in /spɹeɪ/ → [speɪ] 'spray' (see Chapter 5, section 5.9.3, examples (11) to (13), as well as Appendix F for the transcriptions of participants' production). Based on this, there were no cross-group differences that could be discussed, except that those who were provided with aural input, regardless of their L1 literacy, deleted the second member of [fɹaːg].

Regarding deletion in coda position in biconsonantal clusters, participants of all groups, who used deletion, deleted the final consonant if it was [θ], as in /fɔːɹθ/ → [fɔːɾ] 'fourth' and /fɪfθ/ → [fɪf] 'fifth'. A possible explanation for such deletion is because [θ] was a difficult segment for learners to produce. Unlike the deletion of [θ], participants who were exposed to only aural input omitted the first C of the coda cluster if it was a flap or a trill, as in /bəɹd/ → [bəd] 'bird' and /ʃɛlf/ → [ʃɛf] 'shelf'. Also, omission occurred for any member of the consonant cluster, as in the word 'second', in which participants either deleted the first member [n] or deleted the final consonant [d] resulting in either [sekəd] or [sekən], where the latter deletion seemed to be more preferable. This type of deletion is mentioned by Ammar (1999) in her study of typically developing Egyptian Arabic-speaking children's acquisition of consonant clusters in monosyllabic words containing CVCC syllables. Although her participants mostly deleted the final C, she found that participants in some cases deleted the first member of the consonant cluster. For example, the /l/ was deleted in /kalb/ → [ka:b] 'dog'. Participants of this study, specifically those who were provided with aural input, deleted in a similar manner as Ammar's participants deleted.

In terms of deletion in tri-consonant coda clusters, participants of all groups and during both tests (for the OI group) omitted the final segment of the cluster in all learnt words except in the word /gɪfts/ 'gifts'. In this particular consonantal sequence, while learners who were exposed to the orthographic representations (55% of Literate Word Group and 40% of Literate Word Group-post-test 2) deleted the final segment of this cluster similar to the rest of the learnt words, learners who were exposed to aural input used three different deletion patterns: omission of the two final consonants /gɪfts/→ [gɪf] (5% of Non-literate Picture Group), omission of the medial C of the CCC [gɪfs] (35% of Non-literate learners and 26% of Literate Picture Group), or omission of the final C [gɪft] (30% of Non-literate learners and 37% of Literate Learners Picture Group) (see Chapter 5, section 5.9.3, Table 5-28 for more details). These findings provide some evidence that an absence of orthographic input leads L2 learners to make errors that children usually make in their early stages of L1 phonological acquisition (Young-Scholten et al., 1999). Many L1 phonologists (such as Dodd et al. (2006), Preisser et al. (1988), and Ammar (1992, 1999) agree that consonant cluster reduction is a simplification strategy commonly used by young L1 learners. However, regarding the deletion of the two consonants in /gɪfts/→ [gɪf] by the Non-literate Picture Group in this study, Ammar (1992) found similar production by young L1 learners, whereby her participants deleted the whole cluster in a CVCC syllable structure in a word such as /daʔn/ → [da] 'chin'.

Epenthesis

The place where the epenthetic vowel is inserted will be looked at from two different perspectives: (1) the groups' production in the onset, and (2) the environment of vowel insertion in the coda.

Regarding the groups' insertion of the epenthetic vowel in bi-consonantal clusters, none of the participants epenthesised in onsets or in codas. There was some minimal vowel lengthening in the coda in words such as [θɜ˞ɹd] → [θ**ɛi**rd] 'third' (see Chapter 5 and Appendix F for full transcriptions). Although vowel lengthening was not the focus of this study and will be left for future research, participants' production overall is further evidence that Najdi Arabic permits two-consonant clusters in both positions (Abboud, 1979; Ingham, 1994; Alezets, 2007).

Once the structure becomes more complex than NA speakers' L1, however, as in the case of three-consonant clusters, insertion of the epenthetic vowel can be observed. Earlier in this research (in Chapter 5, section 5.9.3) it was shown that participants, when faced with complex structure in onset, used three different positions to insert the epenthetic vowel, as shown in Table 5-27 (repeated below).

Table 6-1: Amount and percentage of epenthesis in three-consonant cluster onsets

Epenthesis	[C**V**C.C]	[**ʔV**CC.C]	[CC**V**.C]
Non-literate Picture Group	0/9 (0%)	3/9 (33%)	6/9 (67%)
Literate Picture Group	12/33 (36%)	14/33 (43%)	7/33 (21%)
Literate Word Group	37/50 (74%)	11/50 (22%)	2/50 (4%)
Literate Word Group post-test 2	51/62 (82%)	7/62 (11%)	4/62 (7%)
*Cells show number of times strategy used / times of epenthesis			

Words are re-syllabified by the insertion of the epenthetic vowel either before the first consonant (prothesis) /CCC/ → [**ʔV**CC.C] as in 'street' [**ʔi**st.ri:t], after the first consonant → (C**V**C.C) as in 'screen' [sik.ɾi:n], or after the second consonant → [CC**V**.**C**] as in [sp**i**.rɪŋ].

Here, there is evidence to suggest that literacy level in L1 and the teaching environment (aural only or OI) during L2 learning triggers L1 phonological transfer. That is, the Non-literate Picture Group inserted the epenthetic vowel in two different positions: either before the consonant cluster ([**ʔV**CC] 33%), or after the second consonant ([CC**V**.C] 67%). For both types of epenthesis, non-literates relied on these formulas, which are accessible through their native Arabic phonological structure. That is to say, they used [CC**V**.C] syllable form depending on the availability of this form in their L1. For the insertion of the glottal stop in [**ʔV**CC], it has been mentioned earlier (Chapter 2, section 2.2.3) that NA speakers prothesise in their native language when faced with triliteral verbs, as in /staʕmal/ → [**ʔi**s.taʕmal] 'he used', since some type of consonant clusters provoke prothesis where a glottal stop is inserted and followed by a vowel (Abboud, 1979; Al-Mohanna, 1998). So, since non-literates did not visually see the target words of L2, and they had no prior knowledge of any other syllable structure (i.e. they had not been taught the CV syllable which is obligatory in MSA), they transferred their 'known' phonological structure from L1 to the 'un-known' syllable of L2.

When L2 learners were familiar with a learnt structure of another language and were not orthographically introduced to the target syllable structure, as in the case of the Literate Picture Group who had learnt MSA, they used 'mixed' epenthesis types, since these syllable structures were previously learned (21% in [CC**V**.C], 43% in [**ʔV**CC.C], and 36% in [C**V**C.C]).[15]

If L2 learners had sufficient knowledge of other syllable structures and were provided with the orthographic input of the target syllable structure during learning, they relied more on what they orthographically learned; i.e. they applied the syllable structure of the previously learned language (MSA) during the acquisition of the new acquired forms (4% in [CC**V**.C], 22% in [**ʔV**CC.C], and 74% in [C**V**C.C]). Applying orthographically learned syllable structure then increased when the written representations of the words were available during testing (7% in [CC**V**.C], 11% in [**ʔV**CC.C], and 82% in [C**V**C.C]). Here, it is worth remembering that the Arabic writing system is described as a 'consonant based-writing', where diacritics, which are not always written, serve as short vowels (see Cook and Bassetti, 2005). Hence, a possible explanation for higher rates of applying [C**V**C.C] could be a combination of the orthographic exposure during L2 learning and the idea of a 'compulsory' CV syllable from becoming literate while learning MSA.

Regarding the environment of vowel insertion in the coda, recall from Chapter 5 (section 5.9.3) that tri-consonantal clusters in word-final position were syllabified in two ways: either after the

[15] Recall, in Chapter 2, section 2.2, it was stated that MSA does not allow CC clustering at onset nor does it allow onsetless syllable.

first consonant as in ‘text’ [tɛ.k**i**st] and in ‘sixth’ [sɪ**.**k**i**sθ], or after the second member of the consonant cluster as in ‘desks’ [dɛs**.**k**i**s]. A possible explanation for such simplification comes from the syllable structure of the NA dialect, where it allows bi-consonant clusters only in word-initial position and does not allow onsetless syllables. Hence, if the word ‘desks’ [dɛs**.**k**i**s] was resyllabified after the first member of the consonant cluster as in ‘sixth’ [sɪ**.**k**i**sθ], it would be *[de.**sk**is]. The medial cluster is not allowed in NA. On the other hand, if the word [sɪ**.**k**i**sθ] was syllabified as the manner of [dɛs**.**k**i**s] it would be *[sɪk**.**isθ], with an onsetless syllable not permitted in Najdi Arabic, which also violates the Onset Principle (Itô, 1989).

Overall, the combination of L1 literacy level and the methods the participants experienced during L2 English learning seem to play an important role in the formation of L2 phonological representations. Participants with no L1 literacy rely on their native phonology and educated L2 learners also apply syllable structures from their exposure to MSA in school.

6.4 Chapter Summary

This chapter has discussed, in light of the reviewed literature, L1 literacy as a factor in the acquisition of L2, aural input during learning compared with orthographic input, and the availability of orthography during testing.

The question raised earlier in Chapter 3, section 3.3, was ‘to what extent is the non-native pronunciation of non-literates similar to not-yet-literate young children’s non-adult pronunciation?’ In addition to the the fact that a lack of L1 literacy skills negatively affects the development of literacy skills in an L2 (Cummins, 1991; Bialystok, 2002; Bigelow and Tarone, 2004), this study has looked at how a lack of literacy in L1 leads to some different interlanguage phonology patterns at the start of aural exposure to a new language. Non-literate L2 learners simplified marked syllable structure using strategies used by children, namely the deletion/omission typically preferred (Dodd, et al., 2006; Preisser et al., 1988; Ammar, 1992; 1999) vs. the epenthesis noted for adult learners by L2 phonologists (such as Weinberger (1987) and Young-Scholten et al. (1999)). Not only this, but only non-literates were found to delete up to two consonants in three-member clusters, such as in /gɪfts/→ [gɪf] ‘gifts’, similar to what Ammar’s (1999) typically-developing Egyptian-Arabic speaking children did in a CVCC syllable structure; i.e. they omitted the whole cluster in a word such as /daʔn/ → [da] ‘chin’. L1 literacy, on the other hand, led to more epenthesis in word initial triconsonantal clusters.

Exposure to the orthography of English was found to have positively affected participants in two ways. Firstly, it eliminated the differences between both strategies used, i.e. epenthesis and deletion. Secondly, it aided participants in learning a more marked syllable structure, i.e. the total number of words learned in three-consonant clusters was significantly higher than for both the non-literates and literates exposed to only aural input. This supports the positive effect of orthography claimed by Escudero et al. (2008), Showalter and Hayes-Harb (2013), Rafat (2015), and Escudero (2015). So, although availability of orthography during testing did not yield any significant effect on epenthesis, it led significantly to less deletion, since participants saw consonants and retained what they saw (Young-Scholten et al., 1999; Bassetti, 2009).

Chapter 7. Conclusions and Future Directions

This chapter concludes the study, presents limitations and suggests future directions.

7.1 Limitations and Future Research

This study focused mainly on the acquisition of marked syllable structure word edges through word learning by Najdi Arabic speakers in monosyllabic words. As NA allows word-initial and final two-consonant clusters, further research is needed to investigate the role of L1 literacy in the acquisition of more complex syllables and longer words, such as those with several syllables. In addition, following scholars such as Weinberger (1987), Ammar (1992, 1999) and Young-Scholten et al. (1999), the author has argued that non-literates' error patterns during L2 acquisition, when only exposed to aural input, are, to some extent, similar to those of young L1 learners. Thus, it is suggested that future research should be undertaken to compare errors made by young L1 learners with those made by non-literate adult L2 learners. This study is evidence that non-literates differ from literates in their acquisition of phonology. The former deleted more than they epenthesised in comparison to literates. There are no studies, to the author's knowledge, that look at the acquisition of syllable structure in a second language by those who are not literate in their native language at the very start of their acquisition of a new language and who are presented with aural-only input. There is a need for future research to be undertaken to enrich this area of L1-L2 literacy effects and orthography effects. It would be useful to compare two groups of non-literates: one that is only exposed to aural input in the L2, as this group was, and one that is also taught through orthography in the L2.

This study has not focussed on segments relevant to the effects of different educational environments, such as aural and orthography, nor has it focused on L1 literacy level in the acquisition of consonants that NA does not have, such as [v], [p] and vowels that do not exist in the L1. Future research can investigate minimal pairs containing consonants such as [v] vs. [f] and [p] vs. [b], which do not exist in the L1.

The current study identified that literacy in the L1 leads to spelling-influenced non-native pronunciation. It also showed that a lack of literacy does not do so. The non-native pronunciation of non-literates was found to be similar to not-yet-literate young children's non-adult pronunciation. Thus, it is suggested that L2 educational institutions use only aural input in L2 teaching, since it led to more epenthesis for even those who were L1 literates. Although non-literates deleted more than literates, all learners who were only exposed to aural input preferred the same strategy that young children use, namely deletion/omission rather than epenthesis, as a strategy to simplify consonant clusters (Weinberger, 1987; Young-Scholten et al., 1999).

7.2 Conclusion

The current study has contributed to the understanding of the effect two scenarios have on L2 phonological acquisition: L1 literacy and orthographic exposure during both L2 learning and testing.

This study started by introducing its contribution in Chapter 1. Following Young-Scholten et al. (1999), Young-Scholten (2002), and Bassetti (2007, 2009), among others, this research studied the influence of exposing L2 learners to the written forms of the target language. It also dealt with literacy as a variable when learning new phonological forms.

This study has identified that a lack of L1 literacy at the early stage of L2 learning affects the phonological acquisition of a syllable structure more complex than that of a learner's L1. Despite the lack of literature related to the impact of L1 literacy on L2 phonetic and phonological acquisition, the results of this study have shown that there are some significant differences between L1 non-literates and L1 literates in the initial stages of their L2 phonological acquisition. Findings have indicated that non-literate learners rely more on deletion if they face a syllable structure more complex than that of their L1 and if they are exposed only to the aural/phonological input.

Revealing more about the role of L1 literacy in L2 acquisition, this study has explored the various ways in which speakers' lack of L1 literacy affects the acquisition of the syllable structure in a new language. Non-literate Najdi Arabic speakers applied the syllable structure of their dialect during the acquisition of an English syllable structure by either locating the epenthetic vowel after the second consonant of the consonant clusters or by locating it before the consonant cluster, but literate learners transferred pre-learned syllables from MSA. That is to say, [CVC.C] is a syllable structure used by all groups except non-literates, since non-literates have not learned that each C in MSA in a word-initial position has to be followed by either a long vowel or short vowel (diacritic).

Both Picture Groups' participants' error patterns while learning English syllable structure, to some extent, were comparable to children's error patterns, as participants deleted up to two consonants in a row similar to the findings of Ammar's studies in 1992 and 1999. The difference between the two groups was that those who were not literate in their L1 relied more on deletion of marked syllables, while L1 literacy, on the other hand, led to more epenthesis.

The current study has added to the body of knowledge on the effect of auditory-orthographic input in that it has presented the importance of the role of orthography in L2 phonological acquisition and proposed that aural-only exposure favours deletion of consonants in clusters (Young-Scholten et al., 1999).

Findings of this study have also revealed that availability of orthographic input has positively affected L2 English learners. However, accessibility to orthographic representations during learning did not only aid earners to achieve better, but also helped them to learn more words than those who were only provided with aural input. These positive effects were found to be statistically significant, especially when learners were faced with structures more complex than those existing in their L1, i.e. in triconsonantal clusters. Hence, this thesis also adds to the findings of previous studies conducted by L2 phonologists such as Escudero et al. (2008), Showalter and Hayes-Harb (2013), Rafat (2015), and Escurdero (2015), who stress the importance of the availability of orthographic input during L2 learning.

Beyond adding to the body of research that focuses on the effects of orthographic exposure during L2 learning, this study has also supported the notion that markedness is pivotal in speakers' syllable errors. Najdi Arabic participants were found to produce more errors when they faced tri-consonant clusters, which are not permitted in their native syllable structure. Hence, findings of this study have supported the predictions of Lado's (1957) CAH, Eckman's (1977) MDH, and Broselow's (1984) Syllable Structure Transfer Hypothesis.

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Appendices

Appendix A

Information Sheet

Title of project: Aural and Orthographic Input: Implications for the Acquisition of English Consonant Clusters by Northern Najdi Arabic Speakers

Name of supervisor: Prof. Martha Young-Scholten

Email: Martha.Young-Scholten@ncl.ac.uk Work phone number: + 44 (0) 191 208 7751

Name of researcher: Saleh Hammad AlAzmi

Email: s.alazmi@ncl.ac.uk; Mobile: +447707762366; 00966500123111

Contact address: School of English Literature language and Linguistics, Percy Building, Newcastle University, Newcastle upon Tyne, Tyne and Wear, NE1 7RU, United Kingdom.

You are being asked to participate in a project on the above title by the above mentioned researcher. Before you decide to participate in this project, you need to read the following information carefully and to understand why this research is being conducted. Please take your time to read the information sheet on this form and feel free to ask me to clarify any information.

THE AIM OF THE STUDY: to explore how exposure to orthographic input OI and aural phonological input (AI) affects Arabic-speaking learners' acquisition of a syllable structure more complex than in their first language (L1).

WHAT IS INVOLVED: Your contribution is voluntary. If you agree to participate, you will be taught English words and phrases. You will be asked to attend ten learning sessions; 20 minutes each. In the first eight lessons, you will be taught six new words in each lesson where you will be asked to do some exercises which include looking at photos on a data show and listening to the name of the item in the photo. This will be followed by a revision in the 9th lesson and a post-test in the 10th. Your anonymised pronunciation will be recorded during the test to be analysed for the purpose of this research.

USAGE OF DATA: Your anonymised recordings will be transcribed according to the International Phonetic Alphabet (IPA) symbols and confirmed through Praat (a sound analysis software).

ANONIMITY: Your recordings will be anonymous. Your real name will never be used when analysing your pronunciation.

DATA STORAGE AND ACCESS: Your pronunciation will be stored in a password protected computer and will only be accessed by the researcher or his supervisors, Prof. Martha Young-Scholten and Dr. S. J. Hannahs. Hard copies of transcriptions and other information documents will be stored in a locked cabinet accessible only to the researcher.

BENEFITS AND RISKS: This study does not carry any foreseeable risks; all that is you are asked to learn a new language. You will not receive any payment for participation. However, voluntarily contribution is helpful for researchers to study second language acquisition L2.

RIGHT TO WITHDRAWAL: Your contribution to this project is voluntary and you have the right to withdraw at any time without giving any reason. Once you decide to withdraw, you can tell me directly or e-mail me at: s.alazmi@newcastle.ac.uk

DISSEMINATION OF RESULTS: The results of this study will be shared by the researcher in presentations, publications, teaching and training.

FURTHER INFORMATION: If you need any further details about this study, please do not hesitate to contact the researcher or his supervisor using the details above.

Now, could you please complete the consent form which the researcher will provide you with and keep this information sheet for your own records.

Consent Form (Arabic Version)

عنوان البحث

"التعليم الصوتي و الهجائي: نتائج اكتساب الأصوات الانجليزية الساكنة المتصلة من قبل متحدثي اللغة العربية في شمال نجد"

اسم المشرفة: أ.د. مارثا يونغ شولتن

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هاتف العمل: ٠٠٤٤١٩١٢٠٨٧٧٥١

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عنوان المراسلة:

مدرسة الأدب الإنكليزي و اللغة و اللغويات

مبنى بيرسي

جامعة نيوكاسل

مدينة نيوكاسل ابون تاين

مقاطعة تاين آند وبير

الرمز البريدي: **NE1 7RU**

المملكة المتحدة

أنت مدعو للمشاركة في المشروع المعنون بالأعلى والذي يجريه الباحث المشار إليه بالأعلى. قبل قرار المشاركة بالمشروع يجب قراءة المعلومات التالية بتمعن و فهم الغاية من القيام بهذا البحث. من فضلك خذ وقتك لقراءة المعلومات المرفقة مع هذا الطلب و لا تتردد بطلب أي توضيح عن أي معلومة.

هدف الدراسة

تهدف هذه الدراسة إلى استكشاف كيف يمكن أن يؤثر المدخول اللغوي الكتابي و المدخول اللغوي الصوتي على اكتساب المتعلمين الناطقين بالعربية لمقاطع صوتية أكثر تعقيداً من المقاطع الصوتية بلغتهم الأم.

ما هو المطلوب منك؟

تعتبر مساهمتك بهذه الدراسة طوعية. إذا وافقت على المشاركة، سوف يتم تدريسك بعض الكلمات و العبارات باللغة الإنكليزية. وسيطلب منك أيضاً حضور عشر جلسات، مدة كل واحدة منها عشرون دقيقة. سوف يتم تدريسك ست كلمات جديدة في كل جلسة من الجلسات الثمان الأولى حيث سيطلب منك القيام ببعض التمارين التي تتضمن النظر إلى صور في عرض للمعلومات و الاستماع إلى اسم الشيء الموجود في الصورة. يلي ذلك مراجعة في الجلسة التاسعة و اختبار لاحق في الجلسة العاشرة. سوف يتم خلال الاختبار تسجيل نطقك للكلمات, والذي سيبقى مجهول الهوية, وسيتم تحليل هذا النطق لاحقاً بغية دراسته.

استخدام البيانات

سوف يتم تفريغ تسجيلاتك الصوتية، والتي ستبقى مجهولة الهوية، وفقاً لرموز الأبجدية الصوتية الدولية و سيتم التأكد من صحة اللفظ من خلال برنامج برات (برنامج تحليل الصوت).

إخفاء الاسم

ستبقى تسجيلاتك الصوتية مجهولة الهوية، ولن يتم الإشارة لاسمك الحقيقي عند تحليل التسجيلات الصوتية.

تخزين البيانات و الوصول إليها

سوف يتم تخزين نطقك للكلمات على جهاز كمبيوتر محمي بكلمة سر, وسيتم الوصول إليها فقط من قبل الباحث أو المشرفون, أ.د. مارثا يونغ شولتن و الدكتور إس ج هاناس. وسيتم تخزين النسخ المطبوعة من التسجيلات الصوتية المفرغة و وثائق المعلومات الأخرى في خزانة مغلقة متاحة للباحث فقط.

المنافع و المخاطر

كل ما سيطلب منك في هذه الدراسة هو تعلم لغة جديدة لذلك لا يمكن التنبؤ بأي مخاطر. لن يدفع لك أي مبلغ مقابل مشاركتك بهذه الدراسة لكن مساهمتك الطوعية ستكون مفيدة جداً للباحث لدراسة اكتساب اللغة الثانية.

الحق بالانسحاب

مشاركتك بهذه الدراسة طوعية و لك الحق بالانسحاب بأي وقت دون إبداء أي سبب. إذا قررت الانسحاب, يمكن أن تخبرني بشكل مباشر أو إرسال بريد الكتروني إلى:

s.alazmi@newcastle.ac.uk

نشر النتائج

سيتم مشاركة نتائج الدراسة من قبل الباحث في العروض الشفهية و الأبحاث الأكاديمية التي تنشر و التدريس و التدريب.

للمزيد من المعلومات

إذا كان لديك أي استفسارات أخرى عن هذه الدراسة، لا تتردد بالتواصل مع الباحث أو المشرفة على العناوين المشار إليها في الأعلى.

هل يمكن من فضلك الآن مل طلب الموافقة على المشاركة بالدراسة و الاحتفاظ بالموجز عن الدراسة التي سيقدمها لك الباحث.

Appendix B

RESEARCH CONSENT FORM

Name of supervisor: Prof. Martha Young-Scholten

Email: Martha.Young-Scholten@ncl.ac.uk Work phone number: + 44 (0) 191 208 7751

Name of researcher: Saleh Hammad AlAzmi

Email: s.alazmi@ncl.ac.uk; Mobile: +447707762366; 00966500123111

Contact address: School of English Literature language and Linguistics, Percy Building, Newcastle University, Newcastle upon Tyne, Tyne and Wear, NE1 7RU, United Kingdom.

I, the undersigned participant confirm that (please tick box appropriately):

1. I have read and understood the information as provided on the information sheet. ☐
2. I have had the opportunity to ask the researcher questions regarding the project and my participation. ☐
3. I understand I can withdraw at any time without giving a reason. ☐
4. I understand that a voice recorder will be used to collect data and I agree to my voice being recorded for the purpose of this research project. ☐
5. I understand that the recording of my voice may be stored in password-protected files computers. ☐
6. I understand that anonymised extracts of my data will be used for the research, training presentations, publications, reports and seminars. ☐

I, along with the researcher, agree to sign and date this informed consent form.

Participant's signature: ……………………… Date: _ _ / _ _ / 2016

Researcher's signature: ……………………… Date: _ _ / _ _ / 2016

Participant Profile

The information you give will be treated as confidential and will only be used in data analysis. Your anonymity will be retained in the presentation of results from the study.

1. Your dialect: ………………………………

2. Age: . . . .

موافقة للمشاركة في البحث

اسم المشرفة: أ.د. مارثا يونغ شولتن

البريد الإلكترون : **martha.young-scholten@ncl.ac.uk**

هاتف العمل: ٠٠٤٤١٩١٢٠٨٧٧٥١

اسم الباحث: صالح حماد العزمي

البريد الإلكتروني : **s.alazmi@ncl.ac.uk**

رقم الموبايل: ٠٠٤٤٧٧٠٧٧٦٢٣٦٦, ٠٠٩٦٦٥٠٠٥١٢٣١١١

عنوان المراسلة:

مدرسة الأدب الإنكليزي و اللغة و اللغويات

بناء بيرسي

جامعة نيوكاسل

مدينة نيوكاسل ابون تاين

مقاطعة تاين آند وبير

الرمز البريدي: **NE1 7RU**

المملكة المتحدة

أنا المشارك الموقع أدناه أؤكد أنني (يرجى وضع علامة ✓ بجانب الخيارات التالية كما هو مناسب):

١. قرأت وفهمت المعلومات على النحو المنصوص عليه في ورقة المعلومات

٢. أتيحت لي الفرصة لطرح الأسئلة على الباحث بشأن المشروع ومشاركتي

٣. أفهم أني استطيع الانسحاب في أي وقت دون إبداء أسباب

٤. أفهم أن جهاز تسجيل صوتي سوف يستخدم لجمع البيانات وأنا أوافق على ان يتم تسجيل صوتي لغرض هذا المشروع البحثي

٥. أفهم أن التسجيل الصوتي الخاص بي قد يتم تخزينه في الحاسوب كملف محمي بكلمة مرور

٦. أفهم بأن مقتطفات من البيانات الخاصة بي سوف تستخدم على شكل مقتطفات مجهولة المصدر لأغراض البحث والتدريب و العروض والمنشورات والتقارير والحلقات الدراسية.

نحن المشارك و الباحث نوافق على التوقيع و تسجيل تاريخ على هذه الموافقة المسبقة

توقيع المشارك: .... **التاريخ: ....**

توقيع الباحث: .... **التاريخ: ....**

الملف الشخصي للمشارك

سيتم التعامل مع المعلومات التي تعطيها على أنها سرية ولن تستخدم إلا في تحليل البيانات. لن يتم الكشف عن هويتك في عرض نتائج الدراسة.

1. اللهجة الخاصة بك: ....العمر: ....

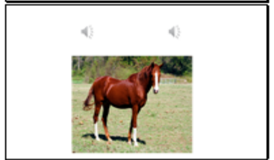
Appendix C

Aural Input

Slide 1

Slide 2

Slide 3



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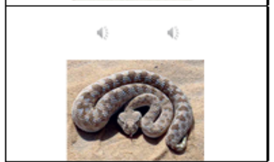

Slide 5

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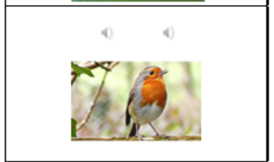
Slide 10



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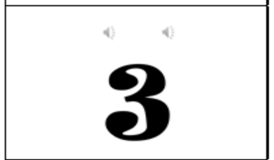
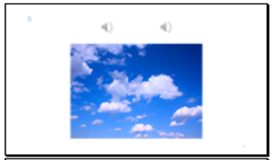


Slide 12

Slide 13



Slide 14

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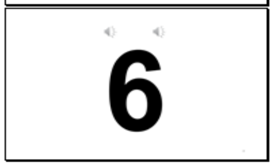
Slide 17

Slide 18

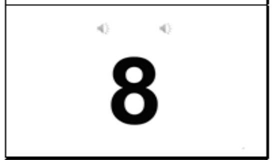


Slide 19

Slide 20

Slide 21

Slide 22



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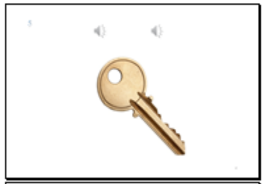
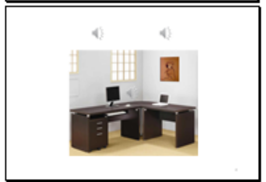
Slide 25



Slide 26

Slide 27

Slide 28



Slide 29

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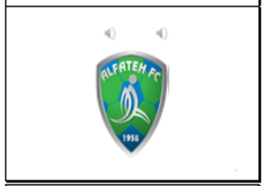
Slide 32

Slide 33

Slide 34

Slide 35

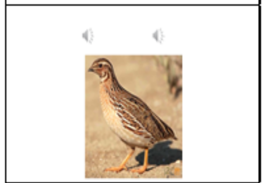


Slide 36

Slide 37

Slide 38

Slide 39



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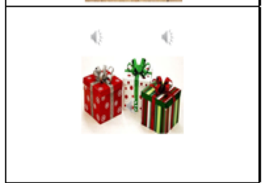

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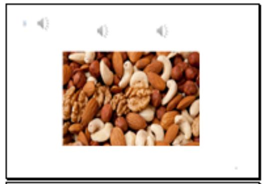
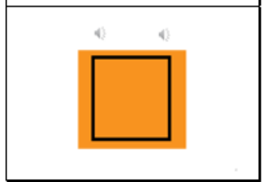
Slide 42



Slide 43

Slide 44

Slide 45



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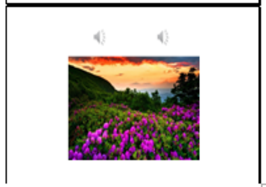
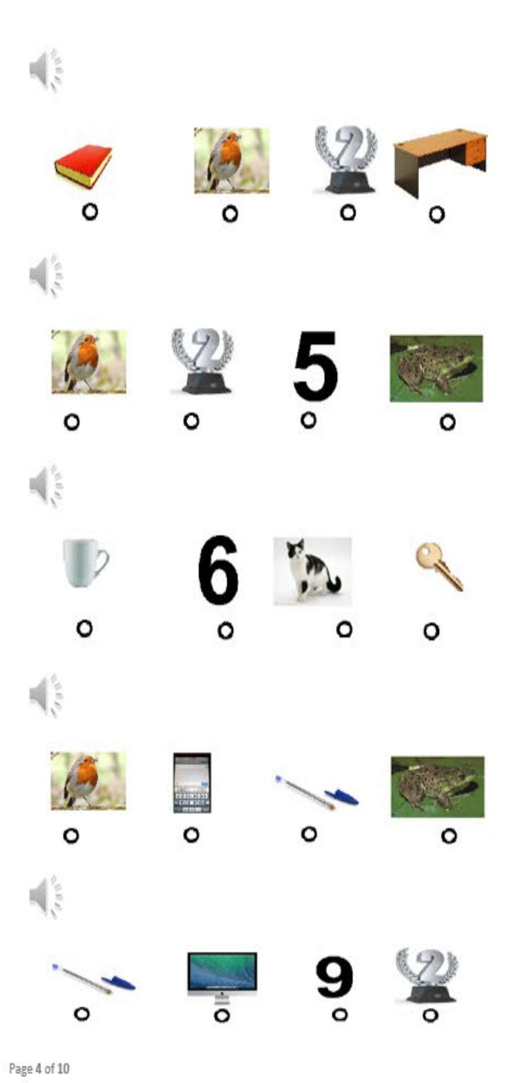


LESSON 9 (REVISION- AURAL GROUPS)

1.

2.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6
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Page 4 of 10


7 6
8 9
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10 6
7 6
Page 5 of 10


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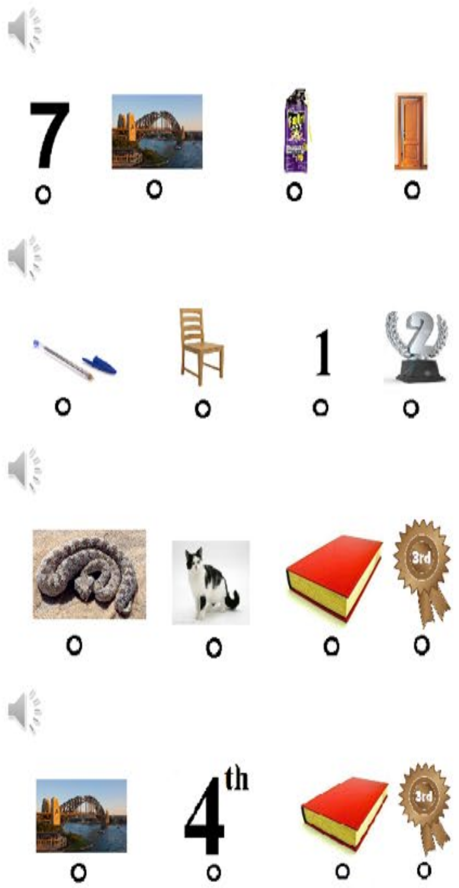
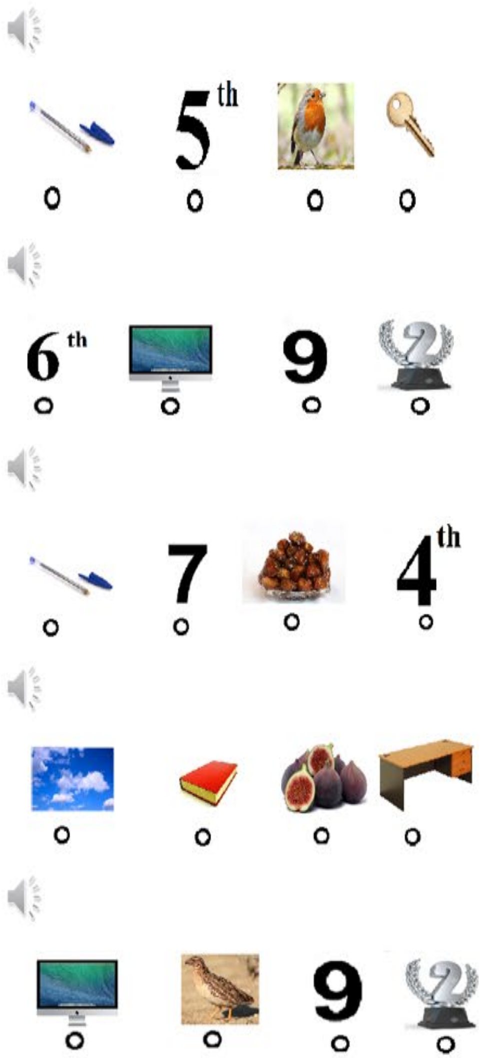
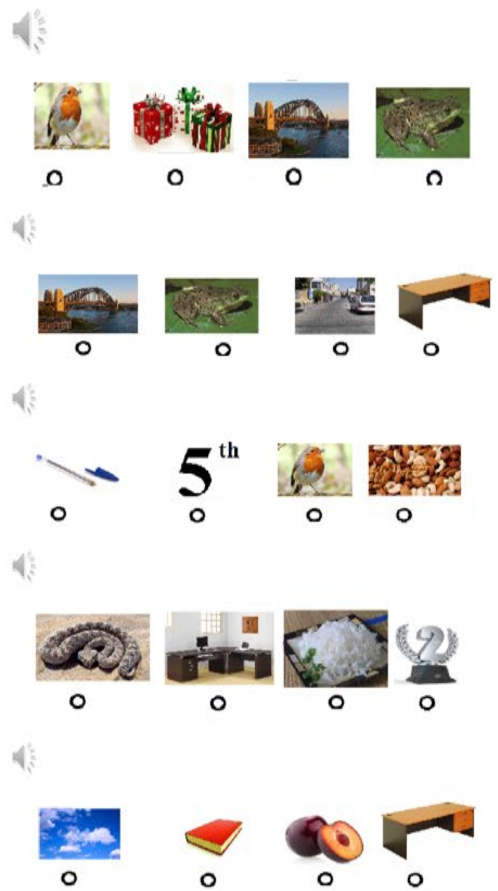
Page 6 of 10



Page 7 of 10



Page 8 of 10



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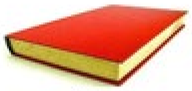
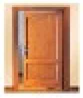
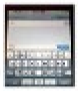
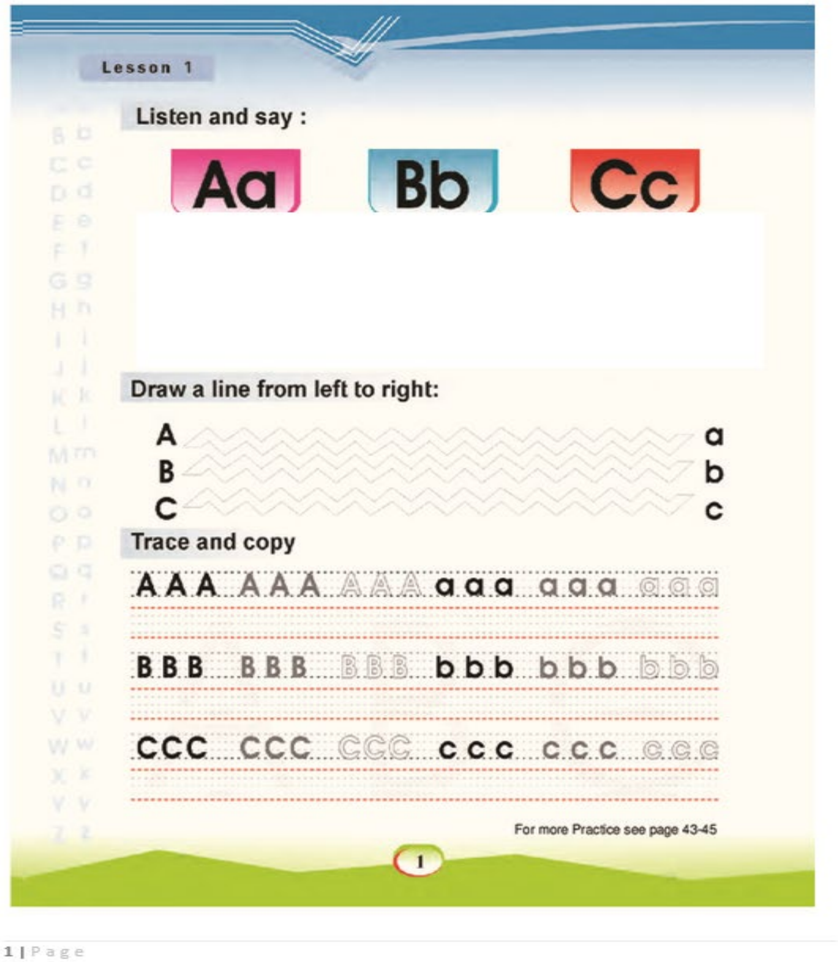
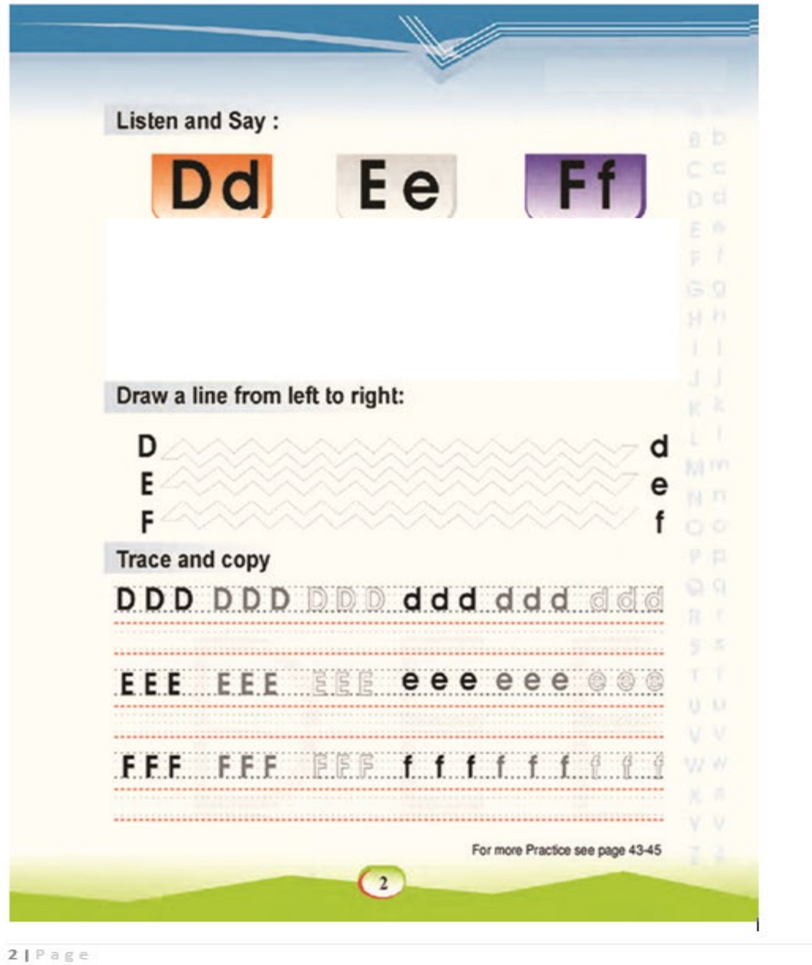
   

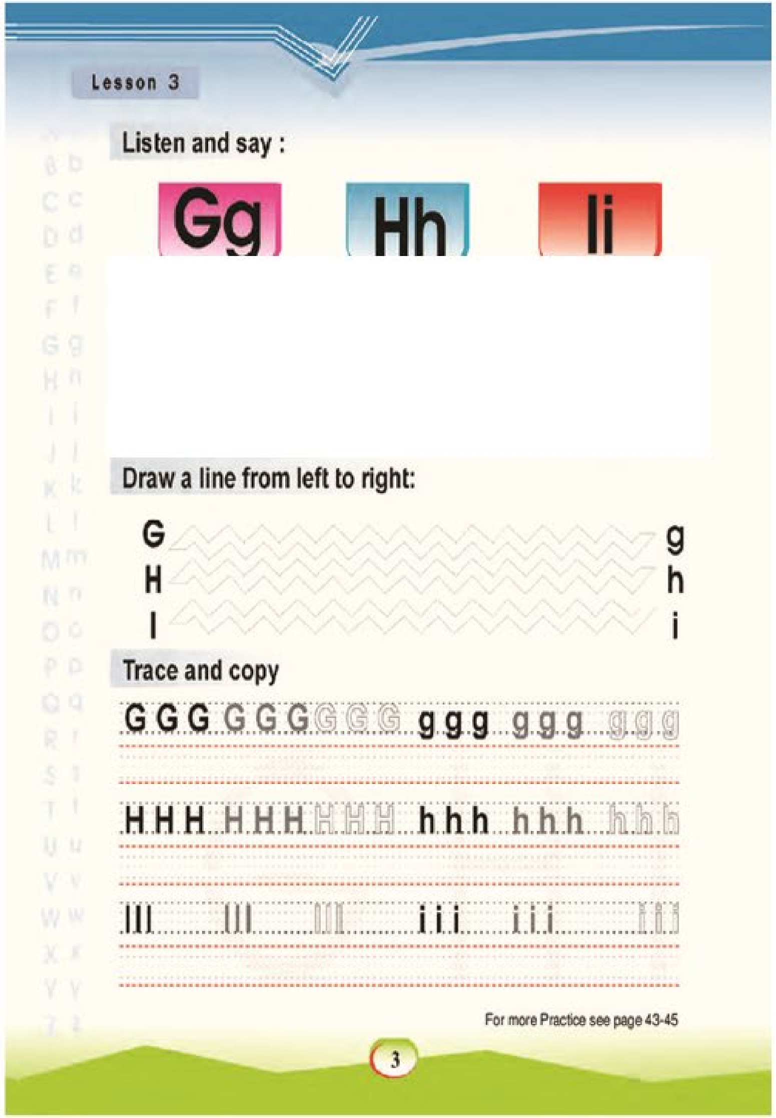
 7  

Appendix D

English Lessons







Lesson 3

Listen and say :

Gg Hh Ii

Draw a line from left to right:

G g
H h
I i

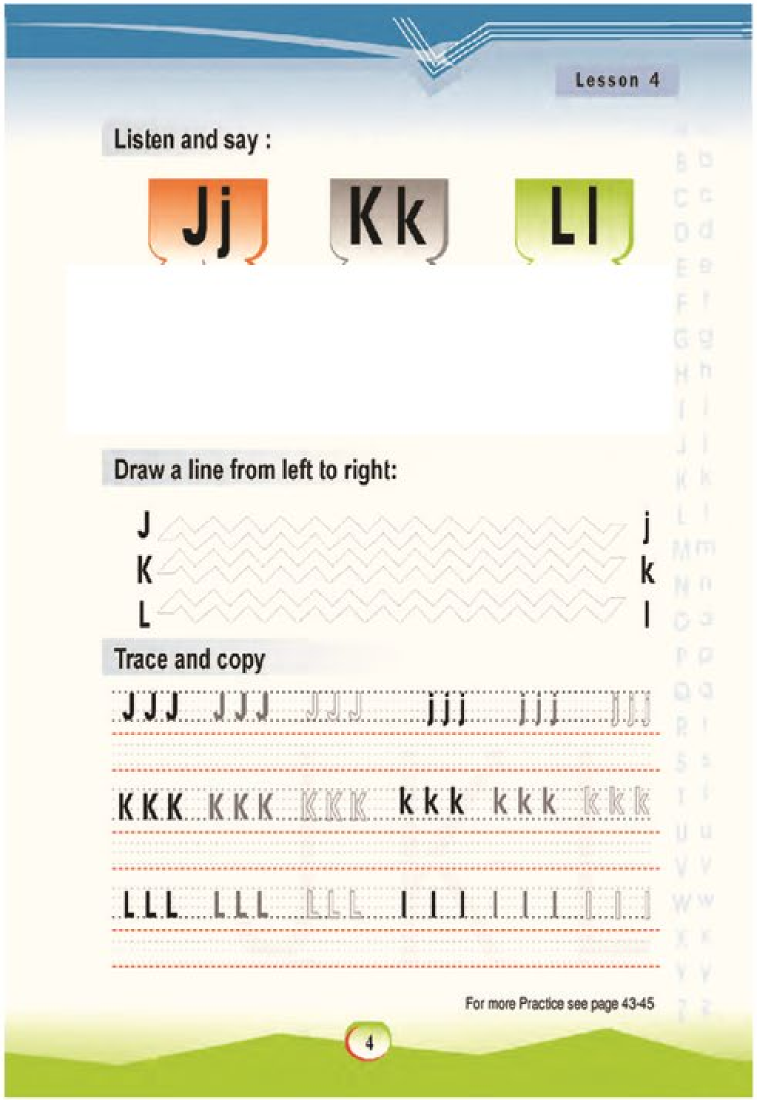
Trace and copy

GGG GGG GGG ggg ggg ggg

HHH HHH HHH hhh hhh hhh

III III III iii iii iii

For more Practice see page 43-45



Lesson 4

Listen and say :

Jj Kk Ll

Draw a line from left to right:

J j
K k
L l

Trace and copy

JJJ JJJ JJJ jjj jjj jjj

KKK KKK KKK kkk kkk kkk

LLL LLL LLL lll lll lll

For more Practice see page 43-45

Lesson 5

Listen and say :

Mm Nn Oo

Draw a line from left to right:

M	m
N	n
O	o

Trace and copy

MMM MMM MMM mmm mmm mmm

NNN NNN NNN nnn nnn nnn

OOO OOO OOO ooo ooo ooo

For more Practice see page 43-45

Lesson 6

Listen and say :

Pp Qq Rr

Draw a line from left to right:

P	p
Q	q
R	r

Trace and copy

PPP PPP PPP ppp ppp ppp

QQQ QQQ QQQ qqq qqq qqq

RRR RRR RRR r r r r r r r r r

For more Practice see page 43-45

Lesson 7

Listen and say :

Ss Tt Uu

Draw a line from left to right:

S s
T t
U u

Trace and copy

S S S S S S S S S s s s s s s s s s

T T T T T T T T T t t t t t t t t t

U U U U U U U U U u u u u u u u u u

For more Practice see page 43-45

Lesson 8

Listen and say :

Vv Ww Xx

Draw a line from left to right:

V v
W w
X x

Trace and copy

V V V V V V V V V v v v v v v v v v

W W W W W W W W W w w w w w w w w w

X X X X X X X X X x x x x x x x x x

For more Practice see page 43-45

Lesson 9

Listen and say :

Yy Zz

Draw a line from left to right:

Y y

Z z

Trace and copy

YYY YYY YYY yyy yyy yyy

ZZZ ZZZ ZZZ zzz zzz zzz

For more Practice see page 43-45

Lesson 10

Letters

Say :

Aa Bb Cc Dd

Ee Ff Gg Hh

Ii Jj Kk Ll Mm

Nn Oo Pp Qq

Rr Ss Tt Uu

Vv Ww Xx

Yy Zz

Lesson 13

Colours

white - red - - yellow

a red apple

4 yellow bananas

What colour is this apple? What colour are these bananas

It is .... They are ....

Lesson 15

Adjectives

hot - cold - big

It is hot.

It is cold

It is **big.**

Say :

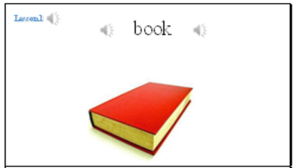
hot

cold

big

Appendix E

Orthographic Input (Lessons and Revision)

Slide 1


Slide 2


Slide 3


Slide 4


Slide 5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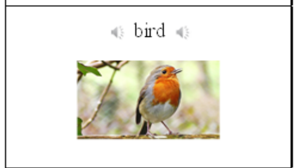
Slide 10


Slide 11


Slide 12


Slide 13


Slide 14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Slide 19


Slide 20


Slide 21


Slide 22


Slide 23


Slide 24


Slide 25

key

Slide 26

pen

Slide 27

shelf

Slide 28

desks

Slide 29

first

Slide 30

second

Slide 31

door

Slide 32

chair

Slide 33

third

Slide 34

fourth

Slide 35

fifth

Slide 36

sixth

Slide 37

date

Slide 38

fig

Slide 39

quail

Slide 40

gifts

Slide 41

street

Slide 42

nut

Slide 43

rice

Slide 44

plum

Slide 45

square

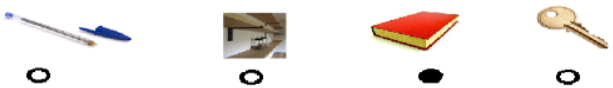
Slide 46

spring

Lesson 9 **Revision (Word Group) 'Sample'**

Listen and choose the correct picture. (The first two examples are done for you.)

1. **Book**



2. **Mug**

---

horse

snake

one

two

dog

cat

frog

bird

Appendix F

Transcriptions of Participants' Production

Non-literate Picture Group NL (CC Onset)

	CC word initial							EPE.	Del.
Words	snake	frog	three	sky	plane	quail	plum		
Trans.	/sneɪk/	/fɹa:g/	/θɹi:/	/skʌɪ/	/pleɪn/	/kweɪl/	/plʌm/		
NL 1	-------	[fra:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
NL 2	[sneɪk]	[fra:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
NL 3	[sneɪk]	[fra:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
NL 4	[sneɪk]	[fra:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
NL 5	[sneɪk]	[fra:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
NL 6	[sneɪk]	[fra:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
NL 7	[sneɪk]	[fa:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	1
NL 8	[sneɪk]	[fa:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	1
NL 9	[sneɪk]	[fa:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	1
NL 10	[sneɪk]	[fa:g]	-----	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	1
NL 11	[sneɪk]	[fa:g]	[θri:]	[skʌɪ]	[bleɪn]	-------	[blʌm]	0	1
NL 12	[sneɪk]	[fa:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	1
NL 13	[sneɪk]	[fa:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	1
NL 14	[sneɪk]	[fra:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
NL 15	[sneɪk]	[fra:g]	[θri:]	[skʌɪ]	-------	[kweɪl]	[blʌm]	0	0
NL 16	[sneɪk]	[fa:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	1
NL 17	[sneɪk]	[fra:g]	[θri:]	------	[bleɪn]	[kweɪl]	[blʌm]	0	0
NL 18	[sneɪk]	[fra:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
NL 19	[sneɪk]	[fra:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
NL 20	[sneɪk]	[fra:g]	[θri:]	[stʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
TOTAL								0	8
Number of Tokens: **135**									

Non-literate Picture Group (CC Coda)

	CC Word Final									EPE.	DEL.
Words	bird	desk	six	shelf	horse	second	third	fourth	fifth		
Trans.	/bəɹd/	/dɛsk/	/siks/	/ʃɛlf/	/hɔːɹs/	/sekənd/	/θəɹd/	/fɔːɹθ/	/fɪfθ/		
NL1	-------	[dɛsk]	[siks]	[ʃɛf]	[hɔːrs]	[sekəd]	[θɝrd]	--------	[fɪfθ]	0	2
NL 2	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekən]	[θɝrd]	[fɔːr]	[fɪft]	0	2
NL 3	-------	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekən]	[θɝr]	[fɔːɾθ]	[fɪfθ]	0	2
NL 4	-------	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekən]	[θɝrd]	[fɔːɾθ]	[fɪfθ]	0	1
NL5	-------	[dɛsk]	[siks]	[ʃɛf]	[hɔːrs]	[sekən]	[θɝrd]	[fɔːɾθ]	[fɪfθ]	0	2
NL 6	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekən]	[θɝrd]	[fɔːrθ]	[fɪft]	0	1
NL 7	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekən]	[θɝrd]	[fɔːrθ]	[fɪft]	0	1
NL 8	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekən]	[θɝrd]	-------	[fɪf]	0	2
NL 9	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekən]	[θɝrd]	[fɔːr]	[fɪfθ]	0	2
NL 10	[bəɾd]	[dɛsk]	[siks]	[ʃɛf]	[hɔːrs]	[sekəd]	[θɝrd]	[fɔːɾθ]	[fɪf]	0	3
NL 11	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekən]	-------	[fɔːɾθ]	[fɪfθ]	0	1
NL 12	[bəɾd]	[dɛsk]	[siks]	[ʃɛf]	[hɔːrs]	[sekən]	[θɝrd]	[fɔːɾθ]	[fɪfθ]	0	2
NL 13	[bəɾd]	[dɛsk]	[siks]	[ʃɛf]	[hɔːrs]	[sekəd]	[θɝrd]	[fɔːɾθ]	[fɪfθ]	0	2
NL 14	[bəɾd]	[dɛsk]	[siks]	[ʃɛf]	[hɔːrs]	[sekən]	[θɝrd]	[[fɔːrθ]	[fɪft]	0	2
NL 15	[bəɾd]	[dɛsk]	[siks]	-------	[hɔːrs]	[sekən]	-------	[fɔːr]	[fɪf]	0	3
NL 16	[bəd]	[dɛsk]	[siks]	[ʃɛf]	[hɔːrs]	[sekən]	[θɝr]	[fɔːr]	[fɪfθ]	0	4
NL 17	[bəd]	[dɛsk]	[siks]	[ʃɛlf]	-------	[sekən]	[θɝr]	[fɔːɾθ]	[fɪf]	0	3
NL 18	[bəd]	[dɛsk]	[siks]	[ʃɛf]	[hɔːrs]	[sekən]	[θ**ɛi**rd]	[fɔːɾθ]	[fɪf]	1	4
NL 19	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekən]	[θɝrd]	[fɔːɾθ]	[fɪfθ]	0	1
NL 20	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θ**ɛi**rd]	[fɔːɾθ]	[fɪf]	1	1
TOTAL										2	41
Number of Tokens: **170**											

Non-literate Picture Group (CCC)

	CCC Word Initial					EPE.	DEL.	CCC Word Final					EPE.	DEL.
Words	spray	screen	street	square	spring			desks	sixth	text	first	gifts		
Trans.	/spɹeɪ/	/skɹi:n/	/stɹi:t/	/skweɹ/	/spɹɪŋ/			/dɛsks/	/sɪksθ/	/tɛkst/	/fəɹst/	/gɪfts/		
NL 1	[speɪ]	[skɾi:n]	[stɾi:t]	[skweɾ]	-------	0	1	---------	[sɪkst]	[tɛkst]	[forst]	[gɪft]	0	1
NL 2	[spɾeɪ]	[skwi:n]	[stɾi:t]	[skweɾ]	[spɾɪŋ]	0	0	[dɛsk]	[sɪkst]	[tɛkst]	[forst]	[gɪfts]	0	1
NL 3	[spɾeɪ]	[skwi:n]	[st**i.**ri:t]	---------	[spŋ]	1	1	[dɛsk]	-------	[tɛks]	-------	[gɪfs]	0	3
NL 4	[speɪ]	[skwi:n]	[stɾi:t]	[skweɾ]	---------	0	1	[dɛsks]	[siks]	[tɛkst]	[fə.ɾist]	[gɪfs]	1	2
NL 5	[speɪ]	[ski:n]	[stɾi:t]	--------	[spɪŋ]	0	3	[dɛsk]	[siks]	[tɛkst]	[forst]	[gɪft]	0	3
NL 6	[spɾeɪ]	[skwi:n]	[stwi:t]	[skweɾ]	[spɾɪŋ]	0	0	[dɛsk]	[sɪks]	[tɛkst]	[fo**.**r**i**s]	[gɪfs]	1	4
NL 7	[speɪ]	[ski:n]	[stɾi:t]	[skweɾ]	[spɪŋ]	0	3	[dɛsk]	[siks]	[tɛks]	[fost]	[gɪft]	0	5
NL 8	[spɾeɪ]	[skɾi:n]	[stɾi:t]	[skweɾ]	[spɾɪŋ]	0	0	[dɛsk]	[sɪkst]	[tɛkst]	[fə**.**r**i**s]	[gɪfts]	1	2
NL 9	[speɪ]	[ski:n]	[st**i.**ɾi:t]	[skweɾ]	[spɪŋ]	1	3	[dɛsk]	[siks]	[tɛkst]	[fə.ɾist]	[gɪfs]	1	3
NL 10	[spɾeɪ]	[ski:n]	[stɾi:t]	[skweɾ]	[spɾɪŋ]	0	1	[dɛsks]	[sɪks]	[tɛkst]	[fəɾst]	[gɪf]	0	3
NL 11	[speɪ]	[skɾi:n]	[sti.ɾi:t]	[skweɾ]	[spɪŋ]	1	2	[dɛsk]	[sɪksθ]	[tɛkst]	[fəɾst]	[gɪft]	0	2
NL 12	[spɾeɪ]	[skwi:n]	[stwi:t]	[skweɾ]	[spɾɪŋ]	0	0	[dɛsk]	[sɪksθ]	[tɛkst]	[fəɾst]	[gɪfs]	0	2
NL 13	[spɾeɪ]	[skɾi:n]	[stɾi:t]	[skweɾ]	[spɾɪŋ]	0	0	[dɛsk]	[sɪkst]	[tɛks]	--------	[gɪft]	0	3
NL 14	[**ʔi**sp**.**ɾeɪ]	[ski:n]	--------	[skweɾ]	--------	1	1	[dɛsks]	[sɪks]	[tɛks]	--------	[gɪfts]	0	2
NL 15	[speɪ]	[ski:n]	[st**i.**ri:t]	---------	[spɪŋ]	1	3	---------	[sɪks]	[tɛkst]	[fəɾs]	[gɪfs]	0	3
NL 16	[spɾeɪ]	[skri:n]	[stɾi:t]	[skweɾ]	[spɾɪŋ]	0	0	[dɛsks]	[sɪks]	[tɛks]	[fəɾs]	[gɪfts]	0	3
NL 17	[spɾeɪ]	[ski:n]	---------	[skweɾ]	[sp**i.**rɪŋ]	1	1	--------	[sɪks]	[tɛks]	[fəɾs]	[gɪfs]	0	4
NL 18	[sp**i.**ɾeɪ]	[skɾi:n]	[stɾi:t]	[skweɾ]	[spɾɪŋ]	1	0	[dɛsk]	[sɪksθ]	[tɛkst]	[fə.ɾist]	[gɪft]	1	2
NL 19	---------	[**ʔi**sk**.**ri:n]	[**ʔi**st**.**ri:t]	[skweɾ]	[spɪn]	2	1	[dɛsk]	[sɪkθs]	-------	[fəɾs]	[gɪfts]	0	2
NL 20	[spɾeɪ]	[skɾi:n]	[stɾi:t]	[skweɾ]	[spɾɪŋ]	0	0	[dɛsks]	[sɪkst]	[tɛkst]	[fə.ɾist]	[gɪfts]	1	0
TOTAL						**9**	**21**	**TOTAL**					**6**	**50**
Number of Tokens: **91**								Number of Tokens: **92**						

Literate Picture Group (CC Onset)

	CC Word Initial							EPE.	Del.
Words	snake	frog	three	sky	plane	quail	plum		
Trans.	/sneɪk/	/fɹa:g/	/θɹi:/	/skʌɪ/	/pleɪn/	/kweɪl/	/plʌm/		
LP 1	[sneɪk]	[fɹa:g]	[θɾi:]	[stʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LP 2	[sneɪk]	[fɹa:g]	[θɾi:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LP 3	[sneɪk]	[fa:g]	[θɾi:]	[stʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	1
LP4	[sneɪk]	[fa:g]	[θɾi:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	1
LP 5	[sneɪk]	[fa:g]	[θɾi:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	1
LP 6	[sneɪk]	[fɹa:g]	[θɾi:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LP 7	[sneɪk]	[fa:g]	[θɾi:]	[stʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	1
LP 8	[sneɪk]	[fa:g]	[θɾi:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	1
LP 9	[sneɪk]	[fɹa:g]	[θɾi:]	[stʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LP 10	[sneɪk]	[fa:g]	------	[skʌɪ]	[bleɪm]	[kweɪl]	[blʌm]	0	1
LP 11	[sneɪk]	[fɹa:g]	[θɾi:]	[skʌɪ]	[bleɪn]	[kwaɪl]	[blʌm]	0	0
LP 12	[sneɪk]	[fa:g]	[θɾi:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	1
LP 13	[sneɪk]	[fɹa:g]	[θɾi:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LP 14	[sneɪk]	[fa:g]	[θɾi:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	1
LP 15	[sneɪk]	[fa:g]	[θɾi:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	1
LP 16	[sneɪk]	[fɹa:g]	[θɾi:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LP 17	[sneɪk]	[fa:g]	[θɾi:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	1
LP 18	[sneɪk]	[fɹa:g]	[θɾi:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LP 19	[sneɪk]	[fɹa:g]	[θɾi:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LP 20	[sneɪk]	[fɹa:g]	[θɾi:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
TOTAL								0	10
Number of Tokens: **139**									

Literate Picture Group (CC Coda)

	CC Word Final									EPE.	DEL.
Words	bird	desk	six	shelf	horse	second	third	fourth	fifth		
Trans.	/bəɹd/	/dɛsk/	/siks/	/ʃɛlf/	/hɔːɹs/	/sekənd/	/θəɹd/	/fɔːɹθ/	/fɪfθ/		
LP 1	[bərd]	[dɛsk]	[siks]	[ʃɛf]	[hɔːrs]	[sekəd]	[θɝɹd]	[fɔːɾθ]	[fɪfθ]	0	2
LP 2	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekəd]	--------	[[fɔːrθ]	[fɪfθ]	0	1
LP 3	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekən]	[θɛːɾd]	[fɔːɾθ]	[fɪf]	1	2
LP 4	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekəd]	[θɛːɾd]	[fɔːɾθ]	[fɪfθ]	1	1
LP 5	[bord]	[dɛsk]	[siks]	[ʃɛf]	[hɔːrs]	----------	[θɛːɾd]	[fɔːɾθ]	[fɪfθ]	1	2
LP 6	[bərd]	[dɛsk]	[siks]	[ʃɛf]	[hɔːrs]	[sekəd]	[θɛːɾd]	[fɔːɾθ]	[fɪfθ]	1	1
LP 7	[bərd]	[dɛsk]	[siks]	-------	[hɔːrs]	[sekən]	-------	[fɔːɾθ]	[fɪfθ]	0	1
LP 8	[bərd]	[dɛsk]	[siks]	[ʃɛf]	[hɔːrs]	[sekənd]	-------	[fɔːɾθ]	[fɪf]	0	2
LP 9	[bərd]	[dɛsk]	[siks]	[ʃɛf]	[hɔːrs]	[sekən]	[θɝɹ]	[fɔːɾθ]	[fɪfθ]	0	3
LP 10	[bərd]	[dɛsk]	[siks]	[ʃɛrf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːɾθ]	[fɪfθ]	0	0
LP 11	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːɾθ]	[fɪfθ]	0	0
LP 12	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekən]	[θɝɹd]	[fɔːɾθ]	[fɪfθ]	0	1
LP 13	[bəd]	[dɛsk]	[siks]	[ʃɛf]	[hɔːrs]	[sekən]	[θɛːɾd]	[fɔːɾθ]	[fɪfθ]	1	3
LP 14	[bərd]	[dɛsk]	[siks]	[ʃɛlθ]	[hɔːrs]	[sekəd]	[θɝɹd]	[fɔːɾθ]	[fɪfθ]	0	1
LP 15	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekən]	[θɝɹd]	[fɔːɾθ]	[fɪft]	0	1
LP 16	-------	[dɛsk]	[siks]	[ʃɛf]	[hɔːrs]	[sekən]	[θɛrd]	[fɔːɾθ]	[fɪf]	0	3
LP 17	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekən]	[θɝɹ]	[fɔːɾθ]	[fɪf]	0	3
LP 18	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekən]	[θɝɹ]	[fɔːr]	[fɪfθ]	0	3
LP 19	[bəd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekən]	[θɛːɾd]	[fɔːɾθ]	[fɪfθ]	1	2
LP 20	[bəd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekən]	[θɝɹ]	[fɔːɾθ]	[fɪfθ]	0	3
TOTAL										5	35
Number of Tokens:**174**											

Literate Picture Group (CCC)

	CCC Word Initial					EPE.	DEL.	CCC Word Final					EPE.	DEL.
Words	spray	screen	street	square	spring			desks	sixth	text	first	gifts		
Trans.	/spɹeɪ/	/skɹiːn/	/stɹiːt/	/skweɹ/	/spɹɪŋ/			/dɛsks/	/sɪksθ/	/tɛkst/	/fəɹst/	/gɪfts/		
LP 1	[speɪ]	[skwiːn]	[stwiːt]	[skweɾ]	[spi.ɾɪŋ]	1	1	[dɛsks]	[sɪkst]	[tɛkst]	[fəɾs]	[gɪfts]	0	1
LP 2	[spɾeɪ]	[skɾiːn]	[stɾiːt]	[skweɾ]	[spɾɪŋ]	0	0	[dɛsk]	[sɪkst]	[tɛkst]	[fəɾs]	[gɪfs]	0	3
LP 3	[sip.ɾeɪ]	[skwin]	[stwiːt]	[skweɾ]	[spɾɪŋ]	1	0	[dɛsks]	[sɪkst]	[tɛkst]	--------	[gɪfts]	0	0
LP 4	[sip.ɾeɪ]	[sik.ɾiːn]	[ʔist.ɾiːt]	[sik.weɾ]	--------	4	0	[dɛsk]	[sɪ.kisθ]	[tɛkst]	[fəɾs]	[gɪft]	1	3
LP 5	[ʔisp.ɾeɪ]	--------	[ʔist.ɾiːt]	[ʔisk.wer]	[ʔisp.ɾɪŋ]	4	0	[dɛsk]	[sɪkst]	[tɛkst]	[fə.rist]	[gɪfs]	1	2
LP 6	[spɾeɪ]	[skɾiːn]	[stɾiːt]	[skweɾ]	[spi.ɾɪŋ]	1	0	[dɛsk]	[sɪks]	[tɛkst]	[fə.ɾist]	[gɪft]	1	3
LP 7	[spɾeɪ]	[skɾiːn]	[stɾiːt]	[skweɾ]	[spi.ɾɪŋ]	1	0	[dɛs.kis]	[sɪ.kisθ]	[tɛ.kist]	--------	[gɪfs]	3	1
LP 8	[spɾʌɪ]	[skɾiːn]	--------	[skweɾ]	[spɾɪŋ]	0	0	[dɛsk]	[sɪ.kisθ]	[tɛkst]	[fəɾs]	[gɪft]	1	3
LP 9	[spɾeɪ]	[sik.ɾiːn]	[sit.ɾiːt]	[sik.weɾ]	[sip.ɾɪŋ]	4	0	--------	[sɪ.kisθ]	[tɛks]	[fə.ɾist]	[gɪft]	2	2
LP 10	[speɪ]	[skɾiːn]	[stwiːt]	[skweɾ]	[spɾɪŋ]	0	1	[dɛsk]	[sɪkst]	[tɛkst]	[fəɾst]	--------	0	1
LP 11	[spɾeɪ]	[skɾiːn]	[stɾiːt]	[skweɾ]	[spɾɪŋ]	0	0	[dɛsk]	[sɪksθ]	[tɛkst]	[fəɾst]	[gɪfts]	0	1
LP 12	[speɪ]	[skɾiːn]	[stɾiːt]	[skweɾ]	[spi.ɾɪŋ]	1	1	[dɛsks]	[sɪksθ]	[tɛkst]	[fəɾs]	[gɪft]	0	2
LP 13	[spi.ɾeɪ]	[ʔisk.ɾiːn]	[stɾiːt]	[ʔisk.weɾ]	[spɾɪŋ]	3	0	[dɛsk]	[sɪksθ]	[tɛkst]	[fə.ɾist]	[gɪft]	1	2
LP 14	[spɾeɪ]	[skwiːn]	[stwiːt]	[skweɾ]	[spɾɪŋ]	0	0	[dɛs.kis]	[sɪ.kisθ]	[tɛkst]	[fəɾs]	[gɪfts]	2	1
LP 15	[spɾeɪ]	---------	--------	[sik.weɾ]	--------	1	0	[dɛsk]	[sɪks]	[tɛks]	[fəst]	[gɪft]	0	5
LP 16	[ʔisp.ɾeɪ]	[ʔisk.ɾiːn]	--------	[ʔisk.weiɾ]	[spɪn]	3	1	[dɛsk]	[sɪks]	[tɛks]	--------	[gɪfs]	0	4
LP 17	[ʔisp.ɾeɪ]	[skiːn]	[ʔist.ɾiːt]	[ʔisk.weɾ]	[ʔisp.ɾɪŋ]	4	1	[dɛsks]	[sɪks]	[tɛks]	[fəɾs]	[gɪfs]	0	4
LP 18	[spɾeɪ]	[ski.ɾiːn]	[stɾiːt]	[skweiɾ]	[spɾɪŋ]	1	0	[dɛsk]	[sɪ.kisθ]	[tɛks]	[fəɾs]	[gɪfs]	1	4
LP 19	[spɾeɪ]	[skɾiːn]	[stɾiːt]	[skweɾ]	--------	0	0	[dɛsk]	[sɪ.kisθ]	[tɛks]	[fəɾs]	[gɪfts]	1	3
LP 20	[spɾeɪ]	[sik.ɾiːn]	[sti.ɾiːt]	[sik.weɾ]	[sip.ɾɪŋ]	4	0	[dɛsk]	[sɪks]	[tɛks]	[fə.ɾis]	[gɪfts]	1	4
TOTAL						33	5	TOTAL					15	49
Number of Tokens: 92								Number of Tokens: 95						

Literate Word Group (CC Onset)

	CC word initial							EPE.	Del.
Words	snake	frog	three	sky	plane	quail	plum		
Trans.	/sneɪk/	/fɹa:g/	/θɹi:/	/skʌɪ/	/pleɪn/	/kweɪl/	/plʌm/		
LW1-1	[sneɪk]	[fɹa:g]	[θri:]	[skʌɪ]	[bleɪm]	[kweɪl]	[blʌm]	0	0
LW1-2	[sneɪk]	[fɹa:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LW1-3	[sneɪk]	[fa:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	--------	0	1
LW1-4	[sneɪk]	[fɹa:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LW1-5	[sneɪk]	[fɹa:g]	[θri:]	[skʌɪ]	[blan]	[kwaɪl]	[blʌm]	0	0
LW1-6	[sneɪk]	[fa:g]	[θri:]	[stʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	1
LW1-7	[sneɪk]	[fɹa:g]	[θri:]	[skʌɪ]	[bla:n]	[kwaɪl]	[blʌm]	0	0
LW1-8	[sneɪk]	[fa:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	1
LW1-9	[sneɪk]	[fɹa:g]	[θri:]	[skʌɪ]	[bleɪn]	[kwɪl]	[blʌm]	0	0
LW1-10	[sneɪk]	[fɹa:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LW1-11	[sneɪk]	[fɹa:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LW1-12	[sneɪk]	[fɹa:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LW1-13	[sneɪk]	[fɹa:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LW1-14	[snæk]	[fɹa:g]	[θri:]	[skʌɪ]	[blæn]	[kweɪl]	[blʌm]	0	0
LW1-15	[sneɪk]	[fɹa:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LW1-16	[snɪk]	[fɹa:g]	[θri:]	[skʌɪ]	[bleɪn]	[kwɪ:l]	[blʌm]	0	0
LW1-17	[sneɪk]	[fɹa:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LW1-18	[sneɪk]	[fɹa:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LW1-19	[sneik]	[fɹa:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LW1-20	[snek]	[fa:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	1
TOTAL								0	4
Number of Tokens:**139**									

Literate Word Group (CC Coda)

			CC Word Final							EPE.	DEL.
Words	bird	desk	six	shelf	horse	second	third	fourth	fifth		
Trans.	/bəɹd/	/dɛsk/	/siks/	/ʃɛlf/	/hɔːɹs/	/sekənd/	/θəɹd/	/fɔːɹθ/	/fɪfθ/		
LW1-1	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːɾθ]	[fɪfθ]	0	0
LW1-2	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːrθ]	[fɪfθ]	0	0
LW1-3	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːɾθ]	[f**a**ɪfθ]	1	0
LW1-4	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekəna]	[θɝɹd]	[fɔːɾθ]	[f**aɪ**fθ]	1	0
LW1-5	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːɾθ]	[fɪfθ]	0	0
LW1-6	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɛːɾd]	[fɔːr]	[fɪf]	1	2
LW1-7	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːrθ]	[fɪfθ]	0	0
LW1-8	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːrθ]	[fɪfθ]	0	0
LW1-9	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːrθ]	[fɪfθ]	0	0
LW1-10	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːɾθ]	[fɪfθ]	0	0
LW1-11	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːɾθ]	[fɪfθ]	0	0
LW1-12	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːr]	[fɪf]	0	2
LW1-13	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔɾθ]	[fɪf]	0	1
LW1-14	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔɾθ]	[fɪfθ]	0	0
LW1-15	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔɾθ]	[fɪfθ]	0	0
LW1-16	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɛrd]	[fɔɾθ]	[f**aɪ**fθ]	1	0
LW1-17	[bəɾd]	[dɛsk]	[səks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔɾ]	[fɪf]	0	2
LW1-18	[bəɾd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θ**ɛː**ɾd]	[fɔɾθ]	[fɪfθ]	1	1
LW1-19	[bɛɾd]	[dɛsk]	[siks]	[ʃɛlf]	-------	[sekən]	[θɛːɾd]	[fɔɾθ]	[fɪfθ]	1	0
LW1-20	[bəɾd]	[dɛsk]	[siks]	------	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔɾθ]	[fɪfθ]	0	0
TOTAL										6	8
Number of Tokens: 178											

Literate Word Group (CCC)

	CCC Word Initial					EPE.	DEL.	CCC Word Final					EPE.	DEL.
Words	spray	screen	street	square	spring			desks	sixth	text	first	gifts		
Trans.	/spɹeɪ/	/skɹiːn/	/stɹiːt/	/skweɹ/	/spɹɪŋ/			/ dɛsks/	/sɪksθ/	/tɛkst/	/fəɹst/	/gɪfts/		
LW1-1	[sip.ɾeɪ]	[sik.ɾiːn]	[stɾiːt]	[sik.weɾ]	[sip.ɾɪng]	4	0	[dɛsks]	[sɪksθ]	[tɛkst]	[fəɾst]	[gɪfts]	0	0
LW1-2	[spɾeɪ]	[skɾiːn]	[stɾiːt]	[skweɾ]	[spɾɪng]	0	0	[dɛsks]	[sɪksθ]	[tɛkst]	[fə.ɾist]	[gɪfts]	1	0
LW1-3	[spɾeɪ]	[skɾiːn]	[stɾiːt]	[skweɾ]	[spɾɪng]	0	0	[dɛs.kis]	[sɪks]	[tɛkst]	[fəɾst]	[gɪft]	1	2
LW1-4	[sip.ɾeɪ]	[sik.ɾiːn]	[stɾiːt]	[sik.weɾ]	[spi.ɾɪŋ]	4	0	[dɛsk]	[sɪks]	[tɛkst]	[fə.ɾist]	[gɪft]	1	3
LW1-5	[sip.ɾeɪ]	[sik.ɾiːn]	[stɾiːt]	[sik.weɾ]	[spɾɪŋ]	3	0	[dɛsk]	[sɪksθ]	[tɛ.kist]	[fə.ɾist]	[gɪft]	2	2
LW1-6	[ʔisp.ɾeɪ]	[ʔisk.ɾiːn]	[ʔist.ɾiːt]	[ʔisk.weɾ]	[ʔisp.ɾɪŋ]	5	0	[dɛs.kis]	[sɪ.kisθ]	[tɛ.kist]	[fə.ɾist]	[gɪf.tis]	5	0
LW1-7	[spɾeɪ]	[skɾiːn]	[stɾiːt]	[sik.weɾ]	[spɾɪŋ]	1	0	[dɛsks]	[sɪksθ]	[tɛkst]	[fəɾst]	[gɪft]	0	1
LW1-8	[spi.ɾeɪ]	[sik.ɾiːn]	[stɾiːt]	[sik.weɾ]	[sip.ɾɪng]	4	0	[dɛsks]	[sɪksθ]	[tɛkst]	[fə.ɾist]	[gɪft]	1	1
LW1-9	[spɾeɪ]	[skɾiːn]	[stɾiːt]	[skweɾ]	[spɾɪŋ]	0	0	[dɛsks]	[sɪksθ]	[tɛkst]	[fəɾst]	[gɪfts]	0	0
LW1-10	[sip.ɾeɪ]	[ski.ɾiːn]	[stɾiːt]	[sik.weɾ]	[spi.ɾɪŋ]	4	0	[dɛs.kis]	[sɪksθ]	[tɛkst]	[fə.ɾist]	[gɪft]	2	1
LW1-11	[speɪ]	[sik.ɾiːn]	[stɾiːt]	[skweɾ]	[sip.ɾɪng]	2	1	[dɛsks]	[sɪks]	[tɛkst]	[fə.ɾist]	[gɪft]	1	2
LW1-12	[sip.ɾɪ]	[skɾiːn]	[stɾiːt]	[skweɾ]	[spɾɪŋ]	1	0	[dɛsks]	[sɪks]	[tɛkst]	[fəɾst]	[gɪft]	0	2
LW1-13	[spɾeɪ]	[skɾiːn]	[stɾiːt]	[skweɾ]	[spɪŋ]	0	1	[dɛsks]	[sɪksθ]	[tɛkst]	[fəɾst]	[gɪfts]	0	0
LW1-14	speɪ]	[sik.ɾiːn]	[ʔist.ɾiːt]	[sik.weɾ]	[sip.ɾɪng]	4	1	[dɛs.kis]	[sɪksθ]	[tɛ.kist]	[fə.ɾist]	[gɪft]	3	1
LW1-15	[speɪ]	[skɾiːn]	[stɾiːt]	[skweɾ]	[spɾɪŋ]	0	1	[dɛs.kis]	[sɪksθ]	[tɛkst]	[fə.ɾist]	[gɪfts]	2	0
LW1-16	[sip.ɾeɪ]	[sik.ɾiːn]	[stɾiːt]	[sik.weɾ]	[sip.ɾɪng]	4	0	[dɛsks]	[sɪks]	[tɛkst]	[fə.ɾist]	[gɪfts]	1	1
LW1-17	[sip.ɾeɪ]	[sik.ɾiːn]	[stɾiːt]	[sik.weɾ]	[sip.ɾɪng]	4	0	[dɛsks]	[sɪksθ]	[tɛkst]	[fə.ɾist]	[gɪfts]	1	0
LW1-18	[ʔisp.ɾeɪ]	[ʔisk.ɾiːn]	[ʔist.ɾiːt]	[ʔisk.weɾ]	[ʔisp.ɾɪŋ]	5	0	[dɛsks]	[sɪksθ]	[tɛks]	[fə.ɾist]	[gɪfts]	1	1
LW1-19	[sip.ɾɪ]	[sik.ɾiːn]	[stɾiːt]	[sik.weɾ]	[sip.ɾng]	4	0	[dɛsk]	[sɪksθ]	[tɛkst]	[fə.ɾist]	[gɪft]	1	2
LW1-20	[spɾeɪ]	[skɾiːn]	[stɾiːt]	[skweɾ]	[ʔisp.ɾɪŋ]	1	0	[dɛs.kis]	[sɪ.kisθ]	[tɛ.kist]	[fə.ɾis]	[gɪfts]	4	1
TOTAL						**50**	**4**	**TOTAL**					**27**	**20**
Number of tokens: 100								**Number of tokens: 100**						

Literate Word Group-post-test 2(CC Onset)

	CC word initial							EPE.	Del.
Words	snake	frog	three	sky	plane	quail	plum		
Trans.	/sneɪk/	/fɹa:g/	/θɹi:/	/skʌɪ/	/pleɪn/	/kweɪl/	/plʌm/		
LW2-1	[sneɪk]	[fra:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LW2-2	[sneɪk]	[fra:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LW2-3	[sneɪk]	[fra:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LW2-4	[sneɪk]	[fra:g]	[θri:]	[skʌɪ]	[blan]	[kweɪl]	[blʌm]	0	0
LW2-5	[sneɪk]	[fra:g]	[θri:]	[skʌɪ]	[bleɪn]	[kwaɪl]	[blʌm]	0	0
LW2-6	[sneɪk]	[fa:g]	[θri:]	[stʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	1
LW2-7	[sneɪk]	[fra:g]	[θri:]	[skʌɪ]	[bla:n]	[kwaɪl]	[blʌm]	0	0
LW2-8	[sneɪk]	[fra:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LW2-9	[sniɪk]	[fra:g]	[θri:]	[skʌɪ]	[bleɪn]	[kwɪl]	[blʌm]	0	0
LW2-10	[sneɪk]	[fra:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LW2-11	[sneɪk]	[fra:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LW2-12	[sneɪk]	[fra:g]	[θri:]	[skʌɪ]	[blan]	[kweɪl]	[blʌm]	0	0
LW2-13	[sneɪk]	[fra:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LW2-14	[snæk]	[fra:g]	[θri:]	[skʌɪ]	[blæn]	[kweɪl]	[blʌm]	0	0
LW2-15	[sneɪk]	[fra:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LW2-16	[snɪk]	[fra:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LW2-17	[sneɪk]	[fra:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LW2-18	[sneɪk]	[fra:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LW2-19	[sneɪk]	[fra:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	0
LW2-20	[sneɪk]	[fa:g]	[θri:]	[skʌɪ]	[bleɪn]	[kweɪl]	[blʌm]	0	1
TOTAL								0	2
Number of tokens: 139									

Literate Word Group-post-test 2 (CC Coda)

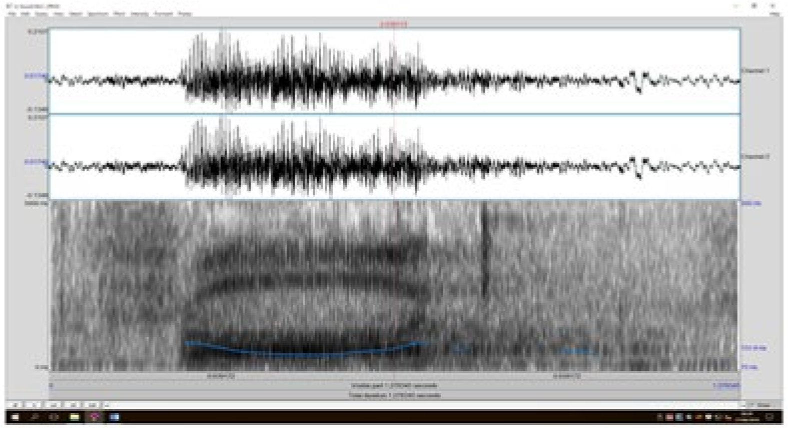
			CC Word Final							EPE.	DEL.
Words	bird	desk	six	shelf	horse	second	third	fourth	fifth		
Trans.	/bəɹd/	/dɛsk/	/siks/	/ʃɛlf/	/hɔːɹs/	/sekənd/	/θəɹd/	/fɔːɹθ/	/fɪfθ/		
LW2-1	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːɾθ]	[f**aɪ**fθ]	1	0
LW2-2	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːɾθ]	[fɪfθ]	0	0
LW2-3	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːɾθ]	[f**aɪ**fθ]	1	0
LW2-4	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːɾθ]	[f**aɪ**fθ]	1	0
LW2-5	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːɾθ]	[f**aɪ**fθ]	1	0
LW2-6	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɛːɾd]	[[fɔɾ]	[fɪf]	1	2
LW2-7	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːɾθ]	[fɪfθ]	0	0
LW2-8	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːɾθ]	[fɪfθ]	0	0
LW2-9	[bɛrd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːɾθ]	[fɪfθ]	0	0
LW2-10	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːɾθ]	[fɪfθ]	0	0
LW2-11	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːr]	[fɪfθ]	0	1
LW2-12	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːɾθ]	[fɪfθ]	0	0
LW2-13	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːɾθ]	[fɪfθ]	0	0
LW2-14	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːrθ]	[fɪfθ]	0	0
LW2-15	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːrθ]	[fɪfθ]	0	0
LW2-16	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɝɹd]	[fɔːrθ]	[fɪfθ]	0	0
LW2-17	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɛːɾd]	[fɔːrθ]	[fɪf]	1	1
LW2-18	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɛːɾd]	[fɔːrθ]	[fɪfθ]	1	0
LW2-19	[bərd]	[dɛsk]	[siks]	[ʃɛlf]	[hɔːrs]	[sekənd]	[θɛrd]	[fɔːrθ]	[fɪfθ]	0	0
LW2-20	[bərd]	[dɛsk]	[siks]	------	[hɔːrs]	[sekənd]	[θɛːɾd]	[fɔːrθ]	[fɪfθ]	1	0
TOTAL										8	4
Number of tokens: 179											

Literate Word Group-post-test 2 (CCC)

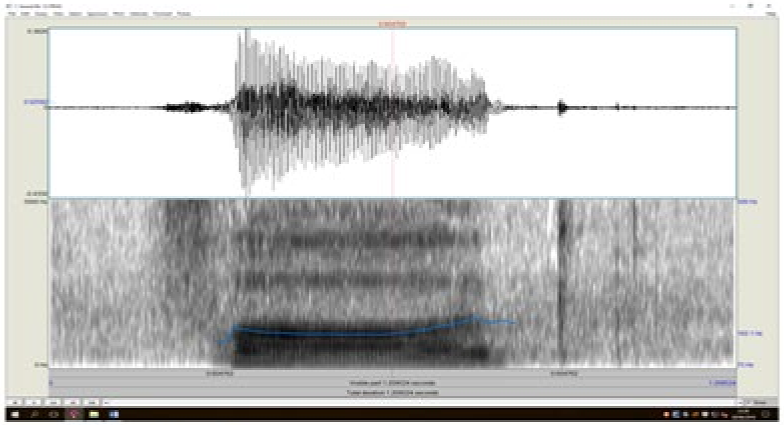
	CCC Word Initial					EPE.	DEL.	CCC Word Final					EPE.	DEL.
Words	spray	screen	street	square	spring			desks	sixth	text	first	gifts		
Trans.	/spɹeɪ/	/skɹi:n/	/stɹi:t/	/skweɹ/	/spɹɪŋ/			/dɛsks/	/sɪksθ/	/tɛkst/	/fəɹst/	/gɪfts/		
LW2-1	[sip.ɾeɪ]	[sik.ɾi:n]	[stɾi:t]	[s**i**k**.**weɾ]	[s**i**p**.**ɾɪng]	4	0	[dɛs**.**k**i**s]	[sɪksθ]	[tɛkst]	[fə.ɾist]	[gɪfts]	2	0
LW2-2	[sip.ɾeɪ]	[sik.ɾi:n]	[stɾi:t]	[sik.weɾ]	[s**i**p**.**ɾɪng]	4	0	[dɛsks]	[sɪksθ]	[tɛkst]	[fə.ɾist]	[gɪfts]	1	0
LW2-3	[sip.ɾeɪ]	[skɾi:n]	[stɾi:t]	[sik.weɾ]	[s**i**p**.**ɾɪng]	3	0	[dɛs**.**k**i**s]	[sɪksθ]	[tɛkst]	[fə.ɾist]	[gɪfts]	2	0
LW2-4	[sip.ɾeɪ]	[sik.ɾi:n]	[stɾi:t]	[sik.weɾ]	[sp**i.**ɾɪŋ]	4	0	[dɛsks]	[sɪks]	[tɛkst]	[fə.ɾist]	[gɪft]	1	2
LW2-5	[sip.ɾeɪ]	[sik.ɾi:n]	[stɾi:t]	[sik.weɾ]	[spɾɪng]	3	0	[dɛsks]	[sɪksθ]	[tɛk**i**st]	[fə.ɾist]	[gɪft]	2	1
LW2-6	[ʔisp.ɾeɪ]	[ʔisk.ri:n]	[ʔist.ɾi:t]	[ʔisk.wer]	[ʔisp.rɪŋ]	5	0	[dɛs**.**k**i**s]	[sɪ.kisθ]	[tɛ**.**k**i**st]	[fə.ɾist]	[gɪf**.**t**i**s]	5	0
LW2-7	[sip.ɾeɪ]	[sik.ɾi:n]	[stɾi:t]	[sik.weɾ]	[sip.ɾɪng]	4	0	[dɛs**.**k**i**s]	[sɪksθ]	[tɛkst]	[fə.ɾist]	[gɪfts]	2	0
LW2-8	[spi.ɾeɪ]	[sik.ɾi:n]	[stɾi:t]	[sik.weɾ]	[sip.ɾɪng]	4	0	[dɛs**.**k**i**s]	[sɪ**.**k**i**sθ]	[tɛ**.**k**i**st]	[fə.ɾist]	[gɪft]	4	1
LW2-9	[spɾeɪ]	[skɾi:n]	[stɾi:t]	[skweɾ]	[spɾɪng]	0	0	[dɛs**.**k**i**s]	[sɪksθ]	[tɛkst]	[fɛrst]	[gɪfts]	1	0
LW2-10	[spi.ɾeɪ]	[sk**i.**ri:n]	[stɾi:t]	[skweɾ]	[sip.ɾɪng]	3	0	[dɛs**.**k**i**s]	[sɪksθ]	[tɛkst]	[fə.ɾist]	[gɪft]	2	1
LW2-11	[speɪ]	[skɾi:n]	[stɾi:t]	[skweɾ]	[sip.ɾɪng]	1	1	[dɛsks]	[sɪksθ]	[tɛkst]	[fə.ɾist]	[gɪfts]	1	0
LW2-12	[sip**.**ɾeɪ]	[sik.ɾi:n]	[stɾi:t]	[sik.weɾ]	[spɾɪng]	3	0	[dɛsks]	[sɪksθ]	[tɛkst]	[fə.ɾist]	[gɪft]	1	1
LW2-13	[spɾeɪ]	[sik.ɾi:n]	[stɾi:t]	[skweɾ]	[spɾɪng]	1	0	[dɛsks]	[sɪksθ]	[tɛkst]	[fə.ɾist]	[gɪfts]	1	0
LW2-14	[sip.ɾeɪ]	[sik.ɾi:n]	[stɾi:t]	[sik.weɾ]	[sip.ɾɪng]	4	0	[dɛs**.**k**i**s]	[sɪ**.**k**i**sθ]	[tɛ**.**k**i**st]	[fə.ɾist]	[gɪft]	4	1
LW2-15	[sip.ɾeɪ]	[skɾi:n]	[stɾi:t]	[sik.weɾ]	[spɾɪng]	2	0	[dɛs**.**k**i**s]	[sɪksθ]	[tɛkst]	[fə.ɾist]	[gɪfts]	2	0
LW2-16	[sip.ɾeɪ]	[sik.ɾi:n]	[stɾi:t]	[sik.weɾ]	[sip.ɾɪng]	4	0	[dɛsks]	[sɪks]	[tɛkst]	[fə.ɾist]	[gɪfts]	1	1
LW2-17	[sip.ɾeɪ]	[sik.ɾi:n]	[stɾi:t]	[sik.weɾ]	[sip.ɾɪng]	4	0	[dɛsks]	[sɪksθ]	[tɛkst]	[fə.ɾist]	[gɪfts]	1	0
LW2-18	[sip.ɾeɪ]	[sik.ɾi:n]	[ʔist.ɾi:t]	[sik.weɾ]	[ʔisp.ɾɪng]	5	0	[dɛs**.**k**i**s]	[sɪksθ]	[tɛks]	[fə.ɾist]	[gɪfts]	1	1
LW2-19	[s**i**p**.**rɪ]	[sik.ɾi:n]	[stɾi:t]	[sik.weɾ]	[sip.ɾɪng]	4	0	[dɛsk]	[sɪksθ]	[tɛkst]	[fə.ɾist]	[gɪft]	1	2
LW2-20	[spɾeɪ]	[skɾi:n]	[stɾi:t]	[sik.weɾ]	[spɾɪng]	2	0	[dɛs**.**k**i**s]	[sɪ.kisθ]	[tɛ**.**k**i**st]	[fo**.ri**s]	[gɪfts]	4	1
TOTAL						**62**	**1**	**TOTAL**					**39**	**12**
Number of tokens: 100								**Number of tokens: 100**						

Appendix G

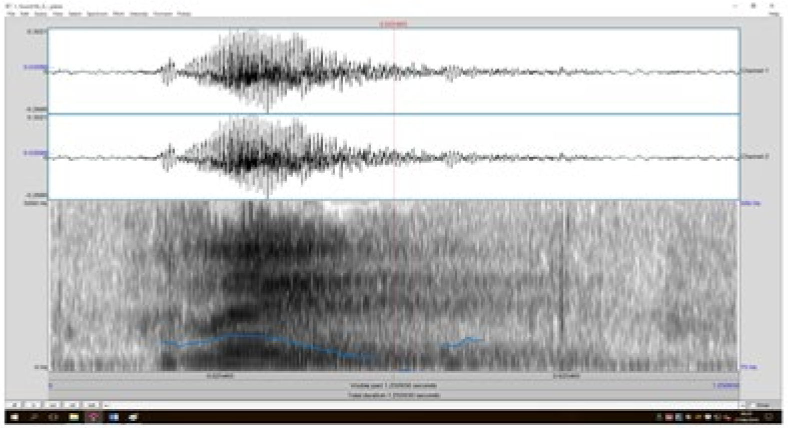
Praat



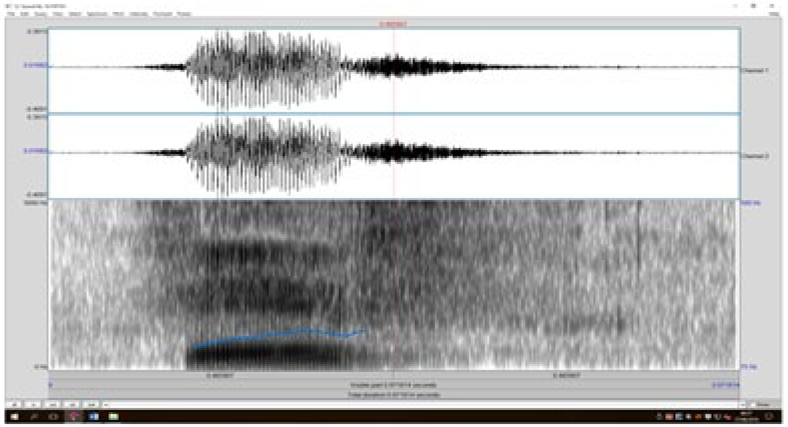
1 NL 2: [fra:g]



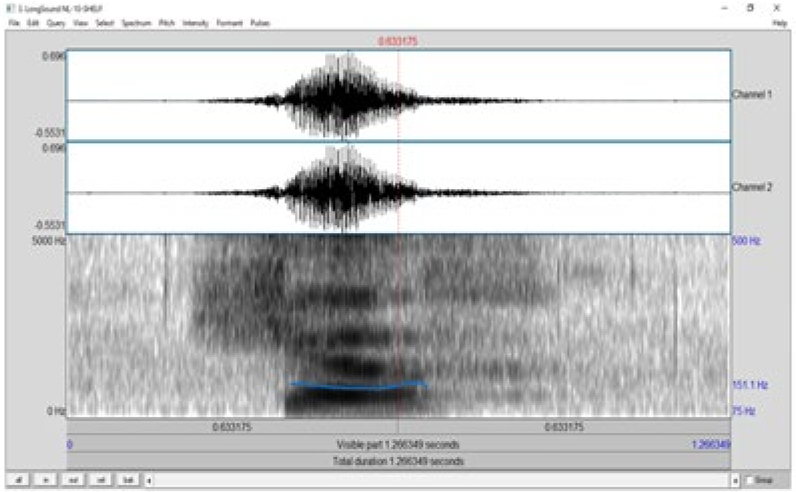
2 NL 13   [fa:g]



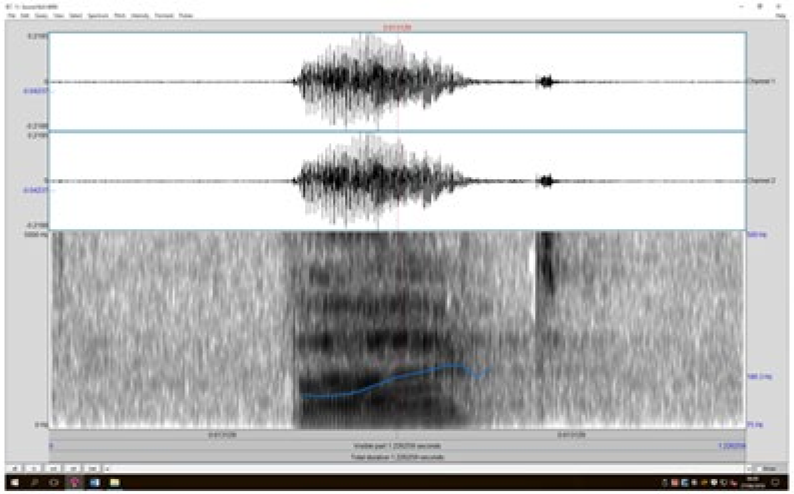
3 NL 8 [bleɪm]



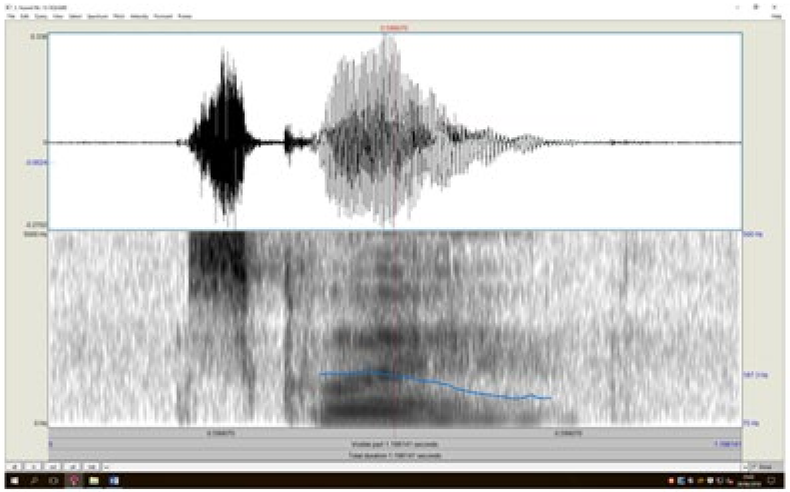
4: NL 10 [fɪf]



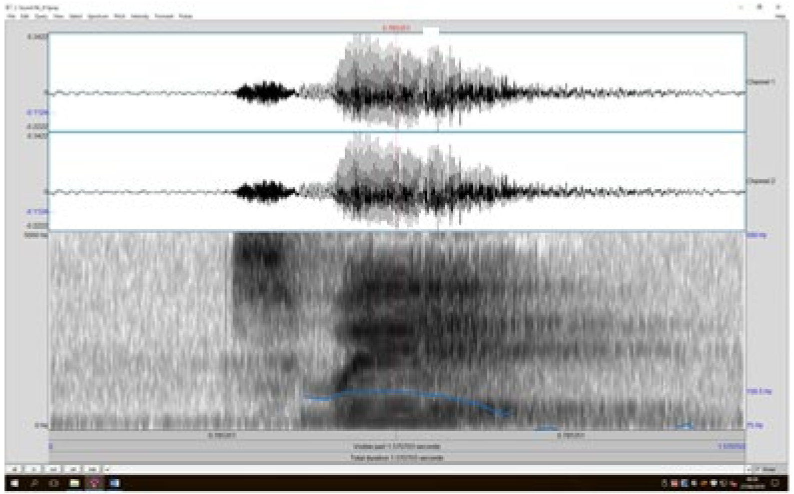
5 NL 10 [ʃɛ f]



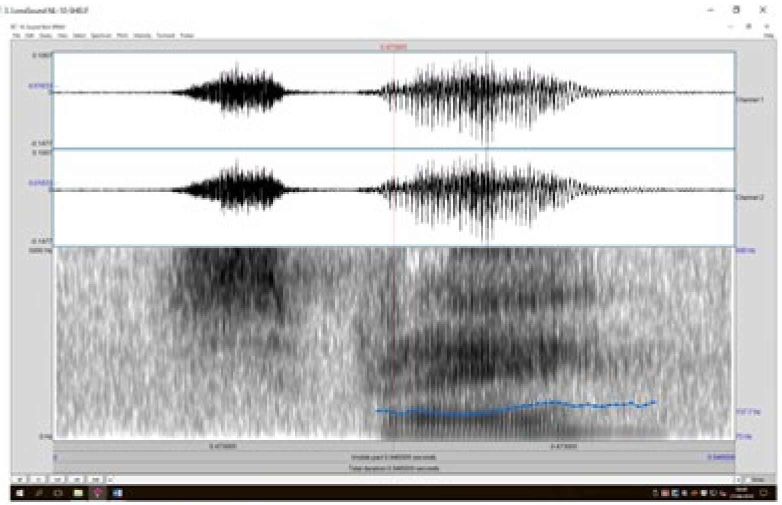
6 NL 8 [bərd]



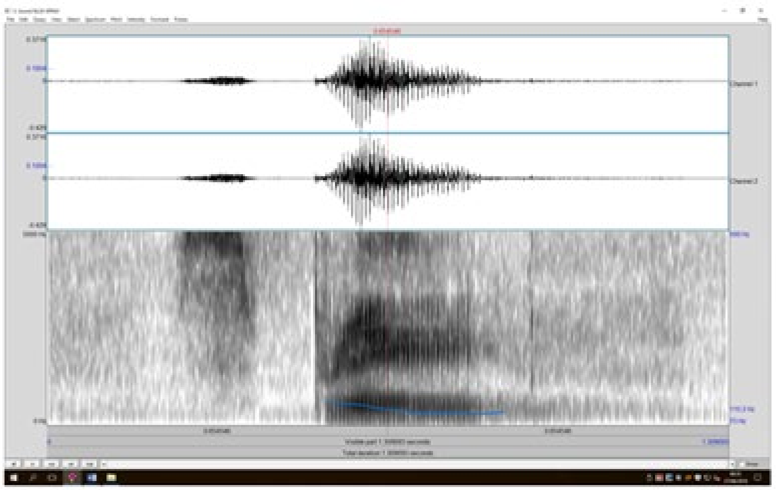
7 NL 13 [skwer]



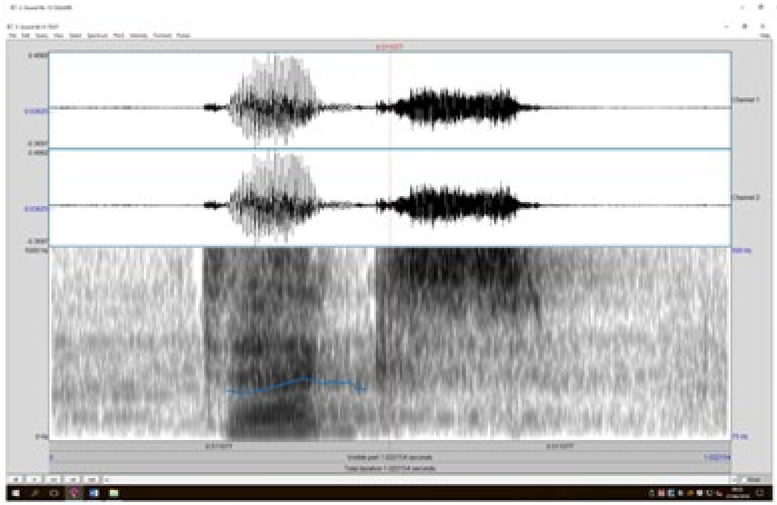
8 NL 9 [sp eɪ]



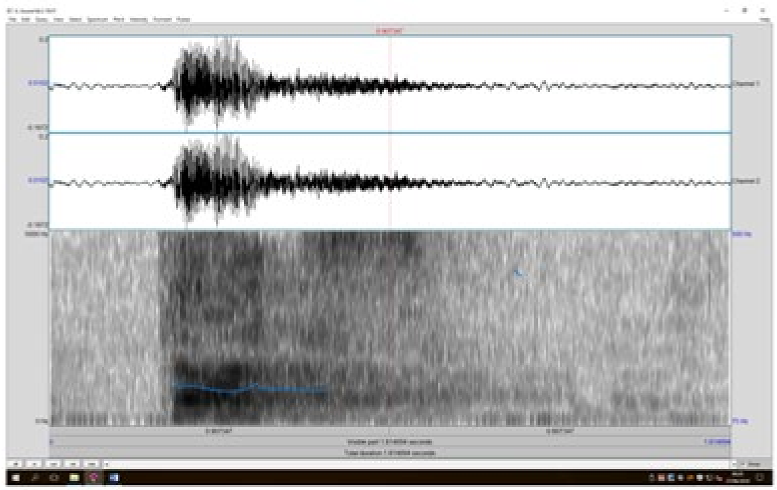
9 NL 10 [spreɪ]



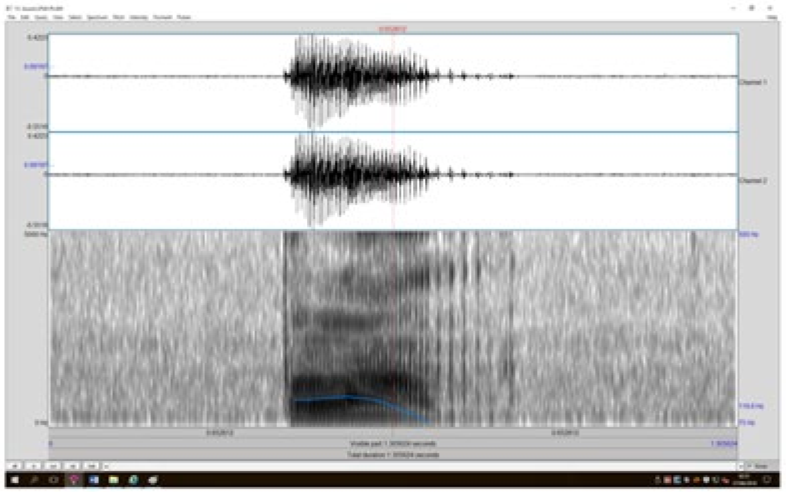
10 NL 20 [spreɪ]



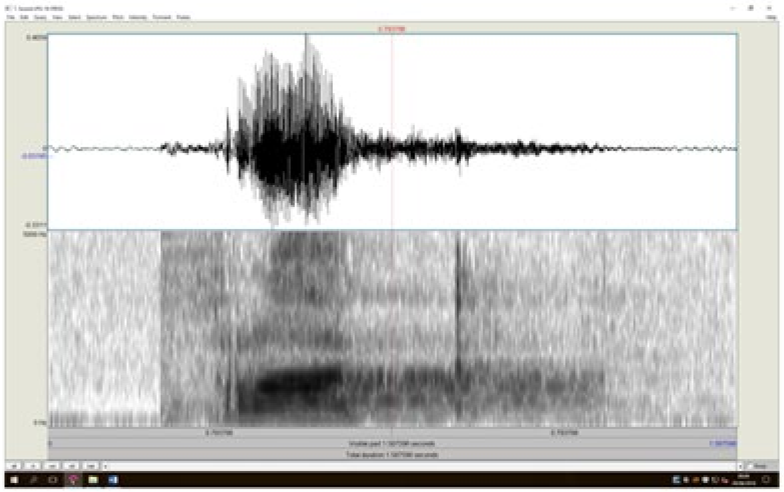
11 NL 13 [tɛks]



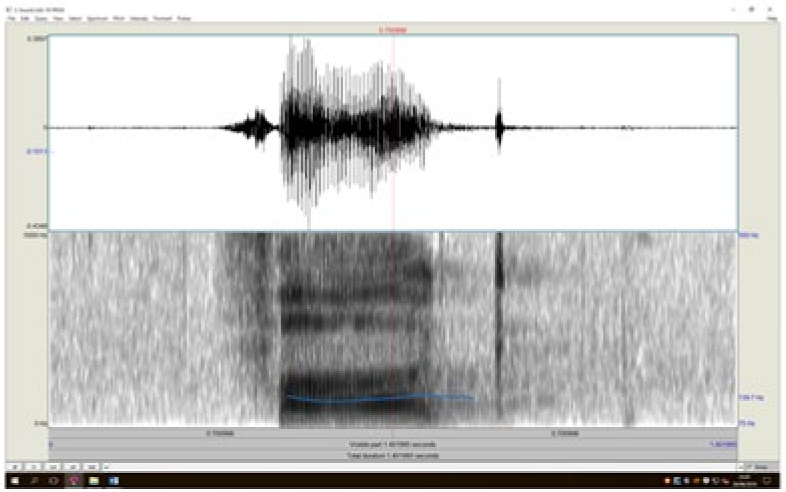
12 NL [tɛks]



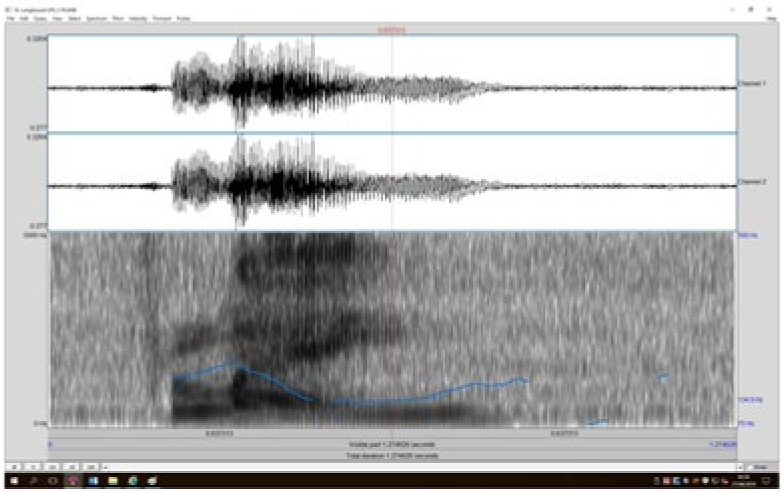
13 LP 8 [blʌm]



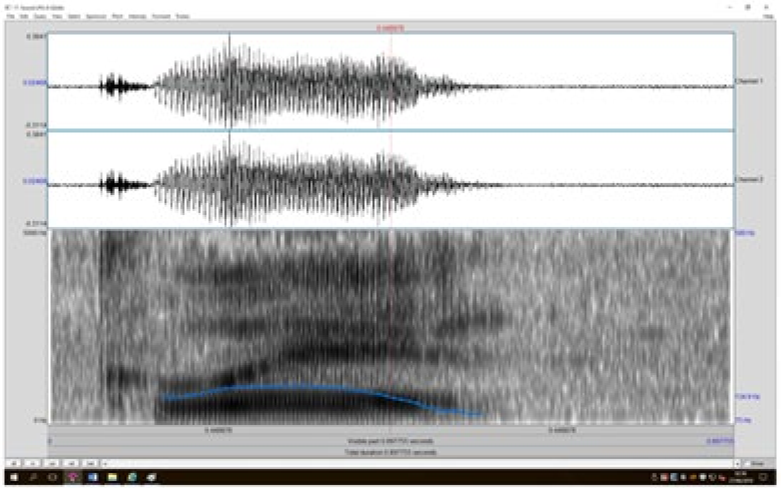
15 LP 16 [fra:g]



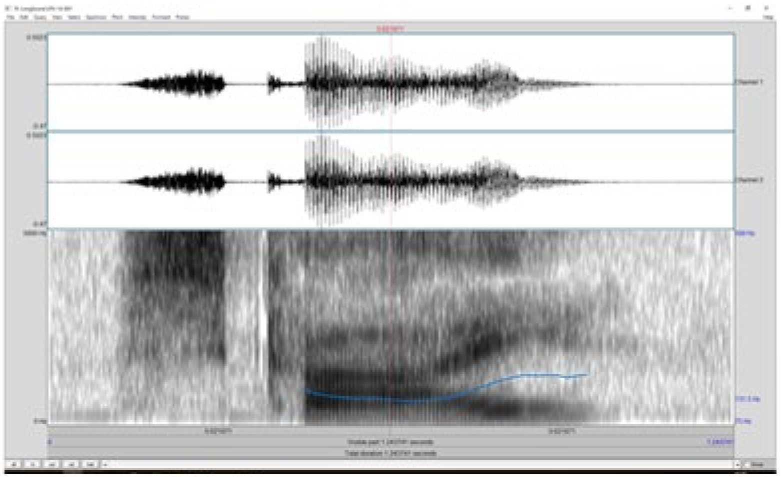
14 LP 10 [fa:g]



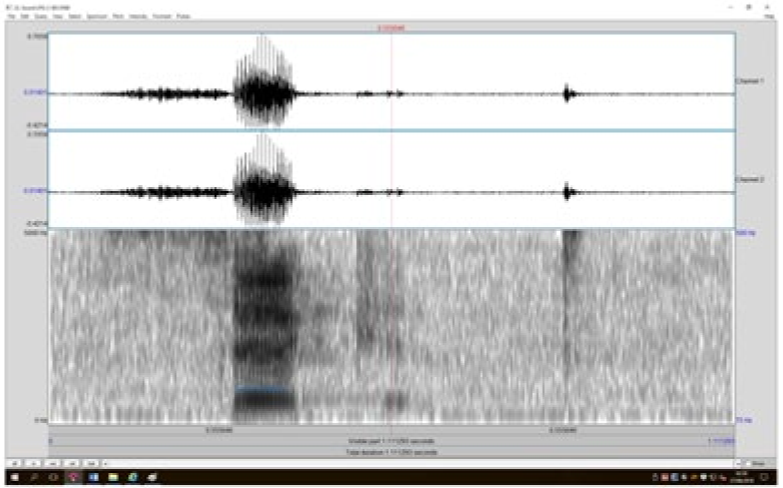
16 LP 2 [bleɪn]



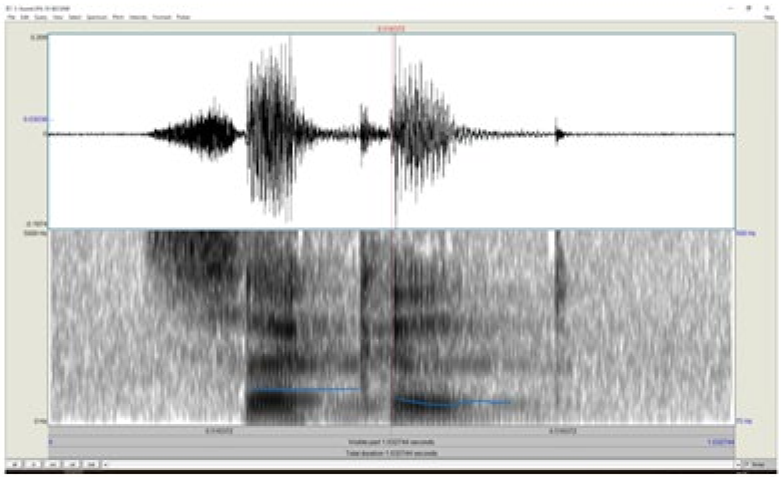
17 LP 8 [kweɪl]



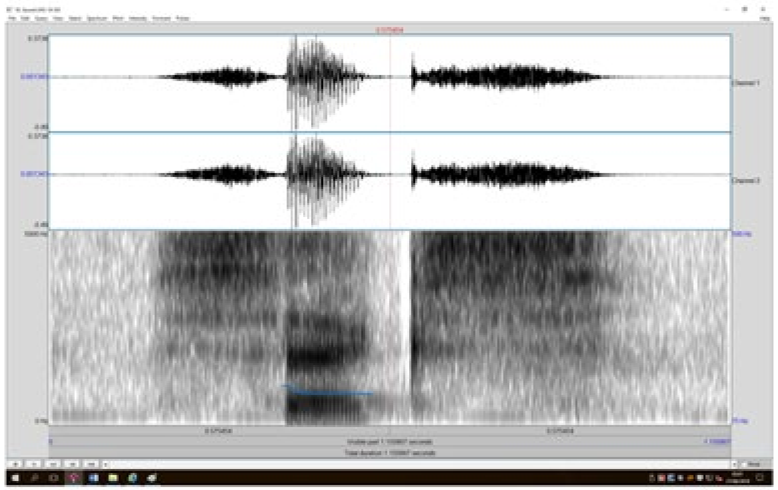
18 LP 14 [skʌɪ]



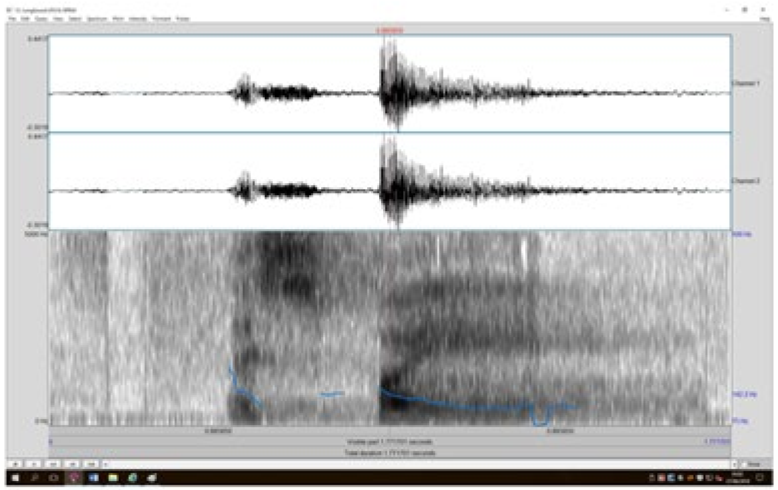
19 LP 2 [sekə d]



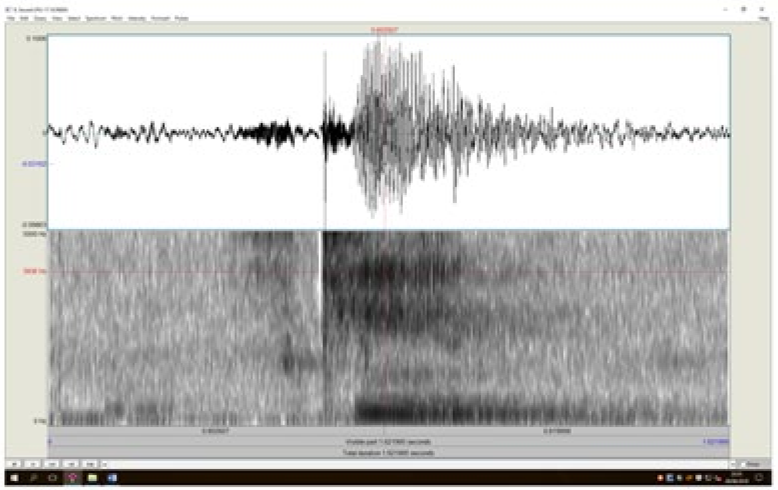
20 LP 6 [sekəd]



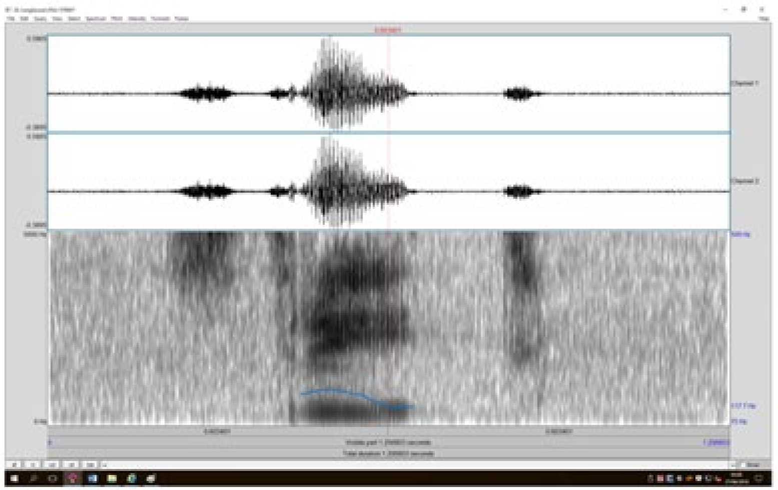
21 LP 14 [siks]



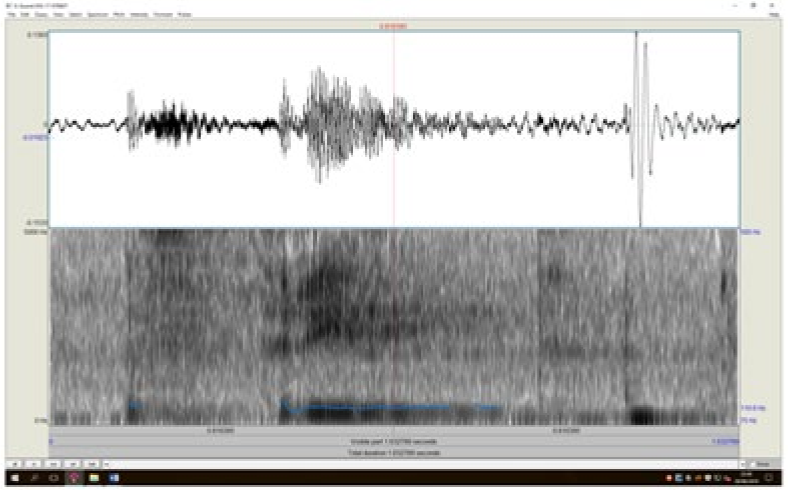
22 LP 16 [ʔisb.reɪ]



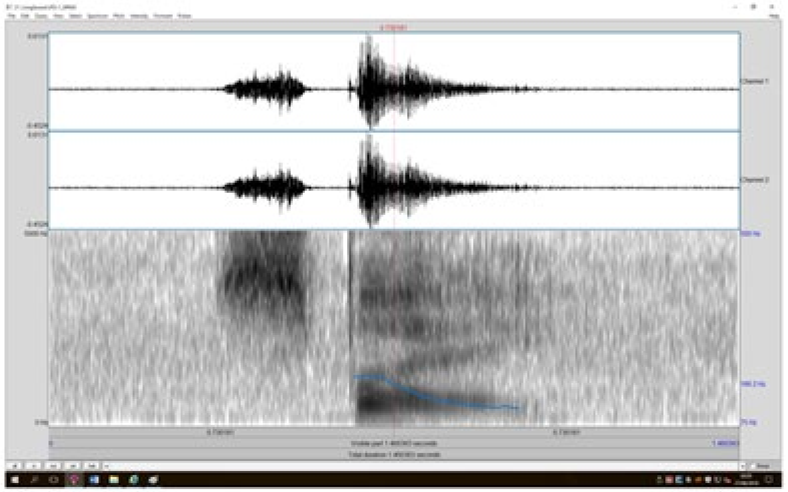
23 LP 17 [sk i:n]



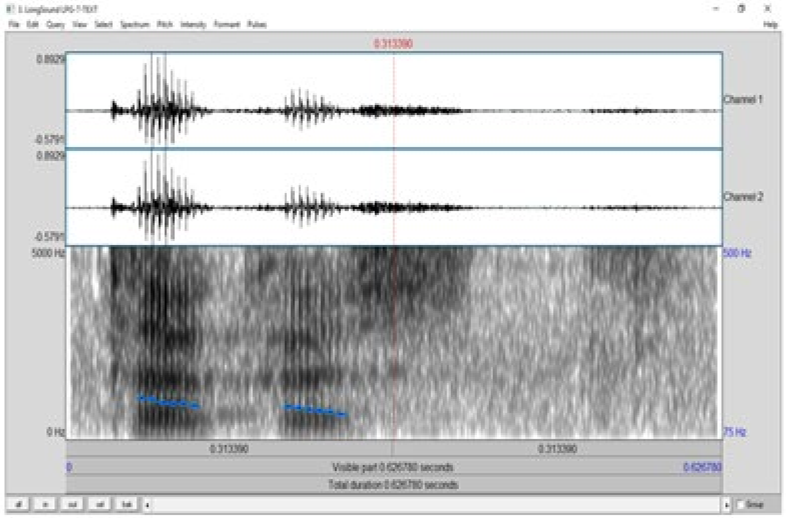
24 LP 2 [stri:t]



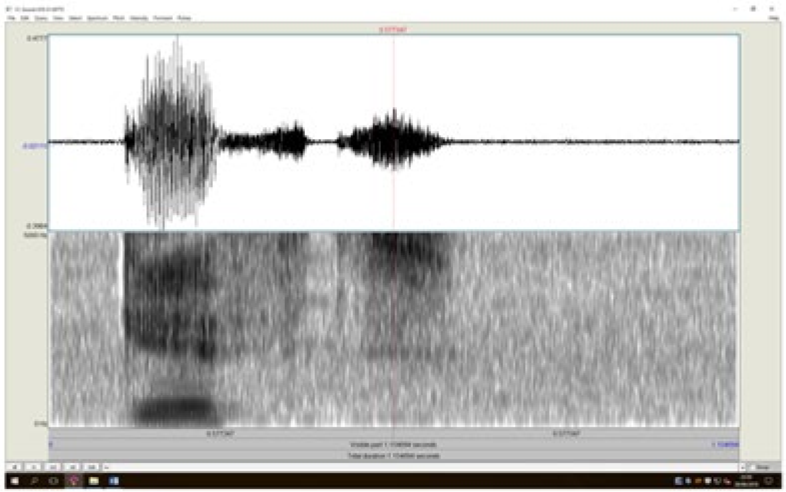
25 LP 17 [ʔist.ri:t]



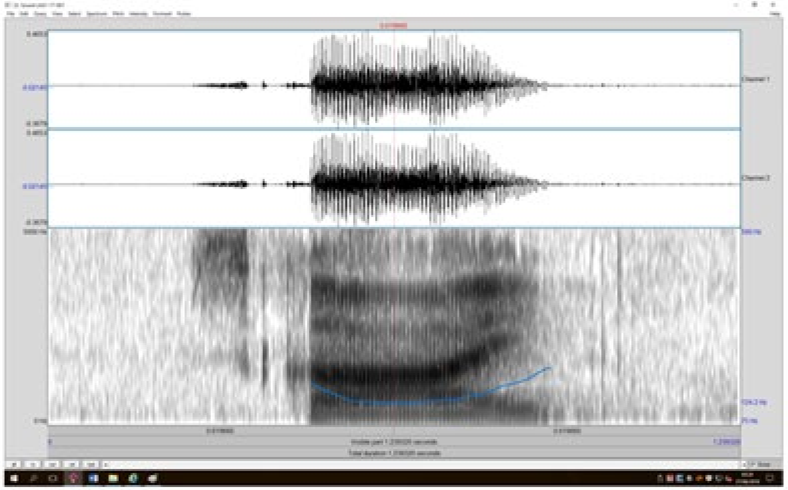
26 LP 1 [sp eɪ]



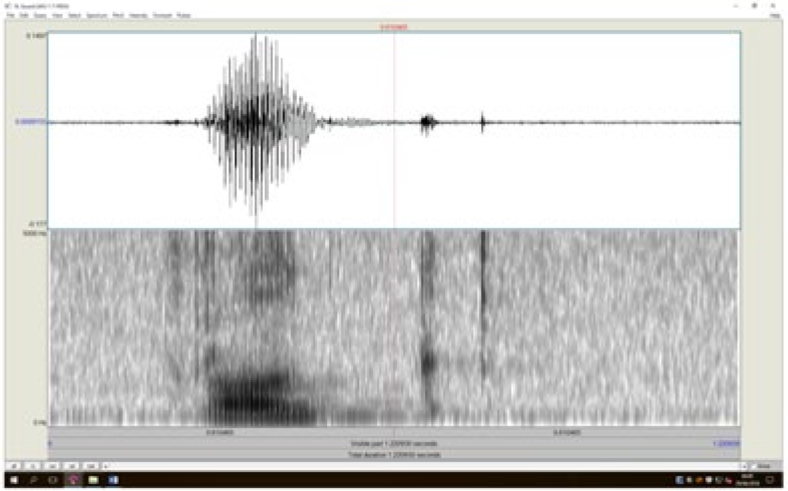
27 LP 7 [te.kist]



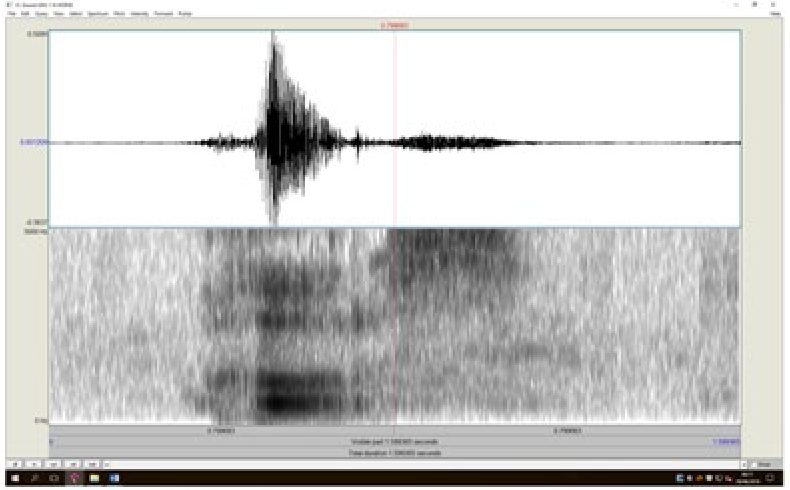
28 LP 8 [gift]



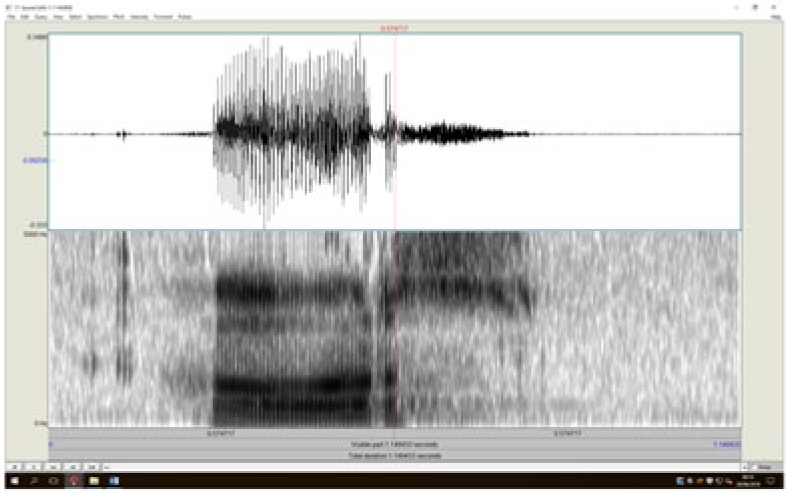
29 LW-1 17 [skʌɪ]



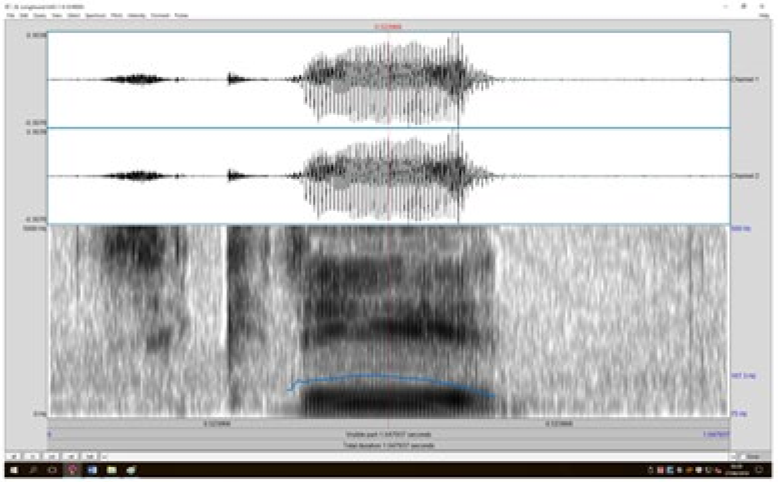
30 LWG-1 7 [fra:g]



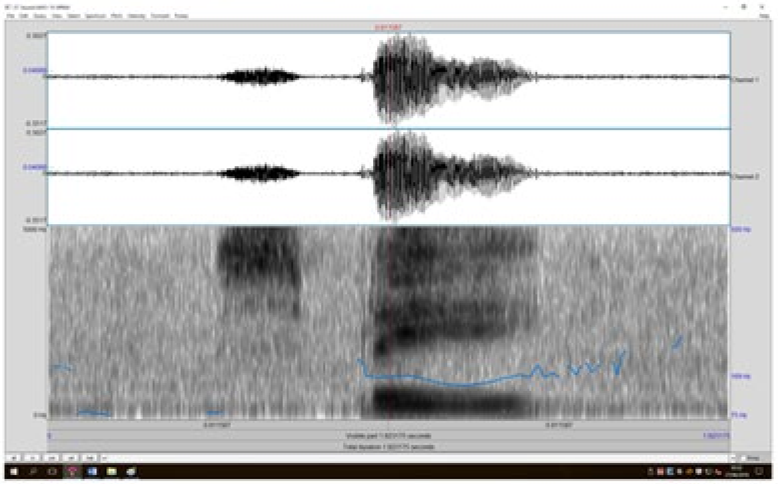
31 LW-1 6 [hɔ:rs]



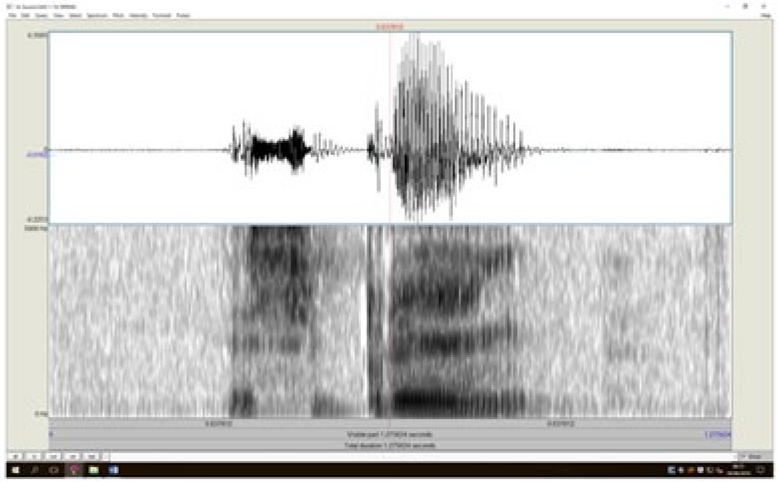
32 LWG-1 7 [hɔ:rs]



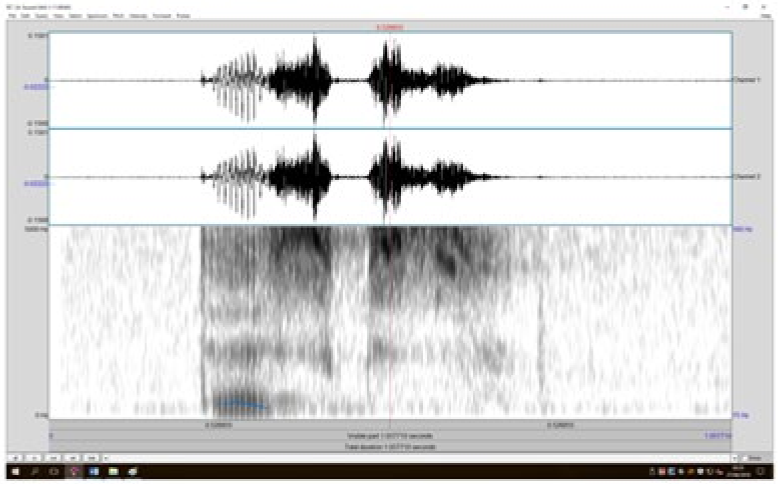
33 LWG-1ˈ 8 [sik.ri:n]



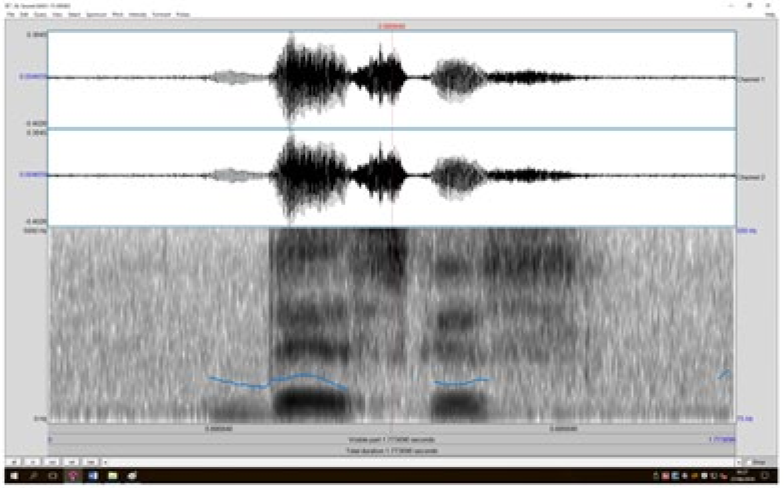
34 LWG-1 15 [speɪ]



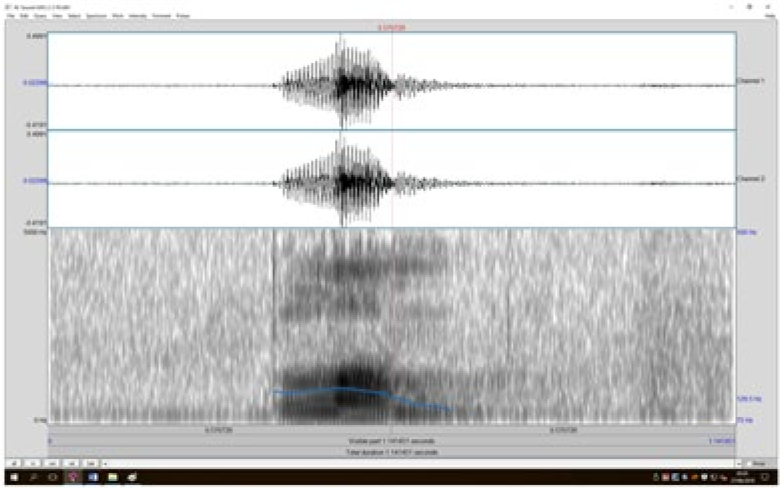
35 LWG-1 18 [ʔisp.rɪŋ]



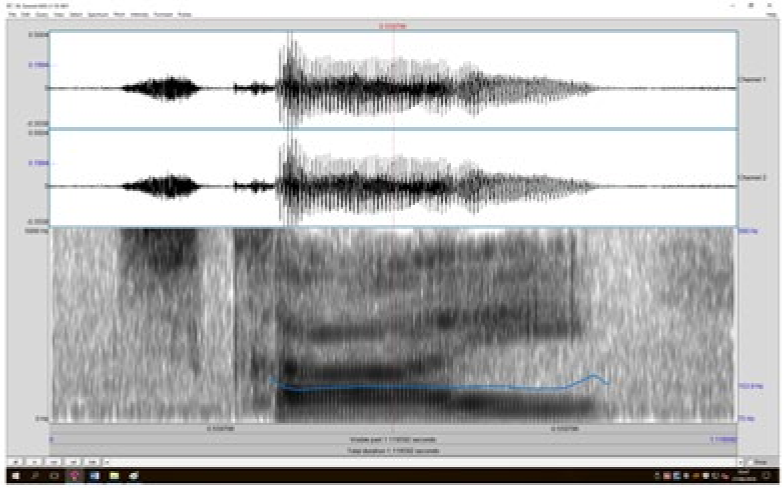
36 LWG-1 7 [dɛsks]



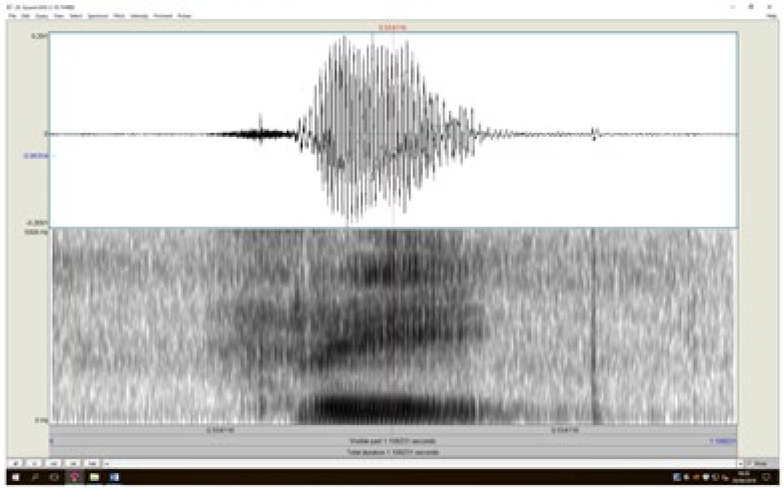
37 LWG-1 15 [dɛs.kis]



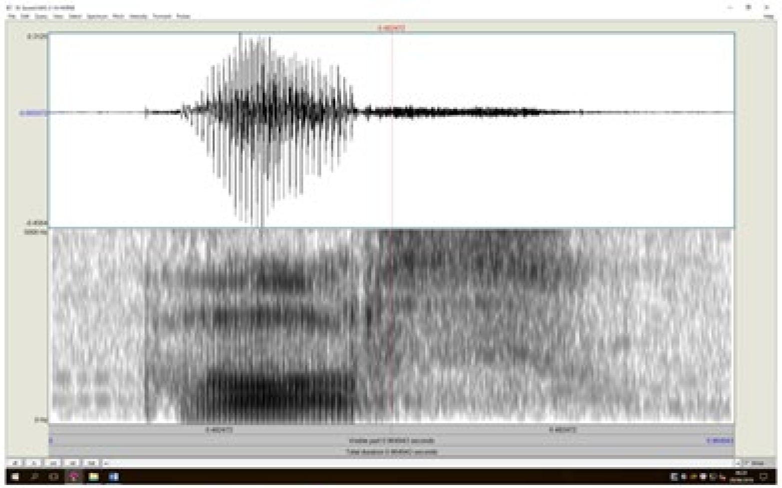
38 LWG2-2 [blʌm]



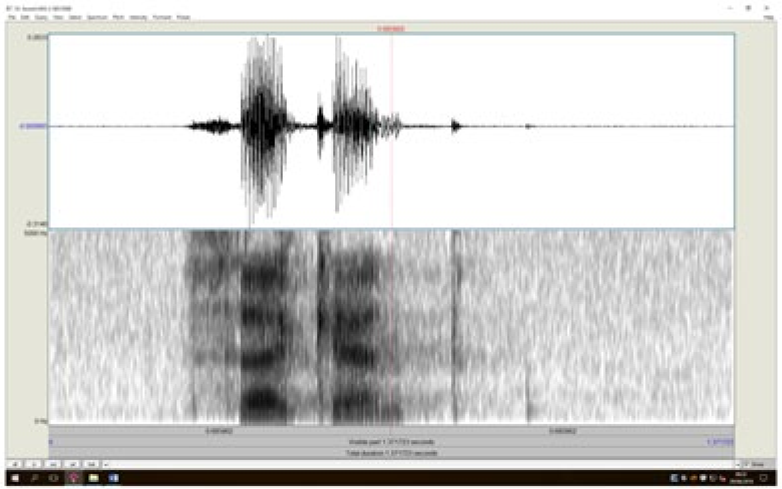
39 LWG2-18 [skʌɪ]



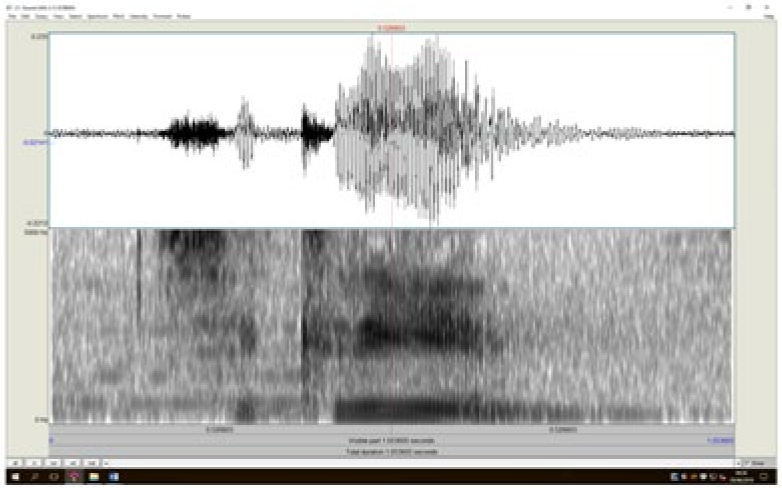
40 LWG2-18 [θri:]



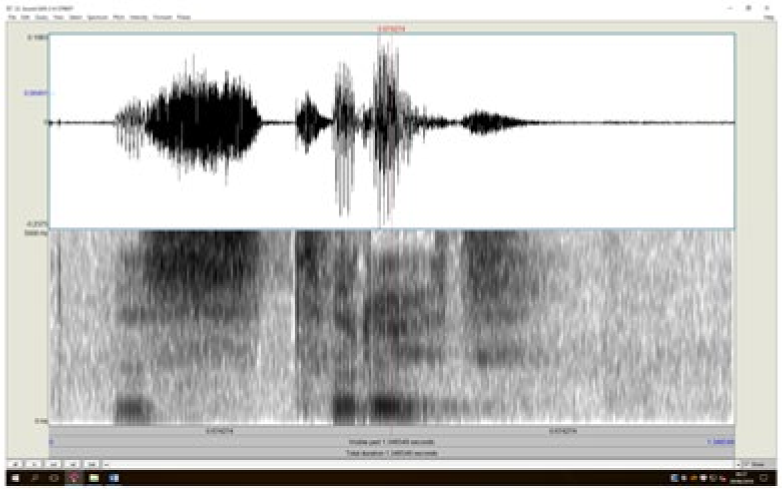
41 LWG2-14 [hɔːrs]



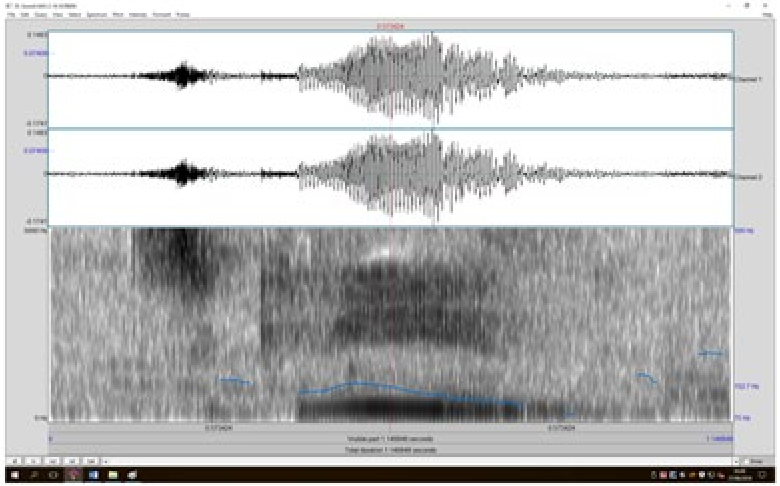
42 LWG2-12 [sekənd]



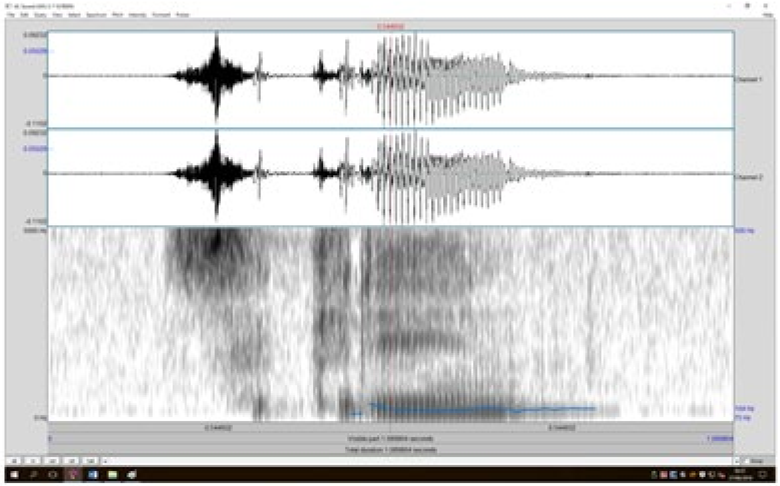
43 LWG2-5 [sik.riːn]



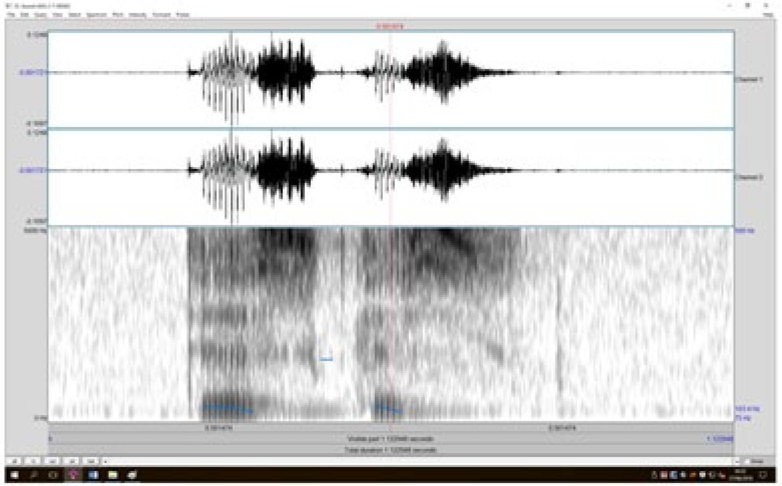
44 LWG2-6 [ʔist.rit]



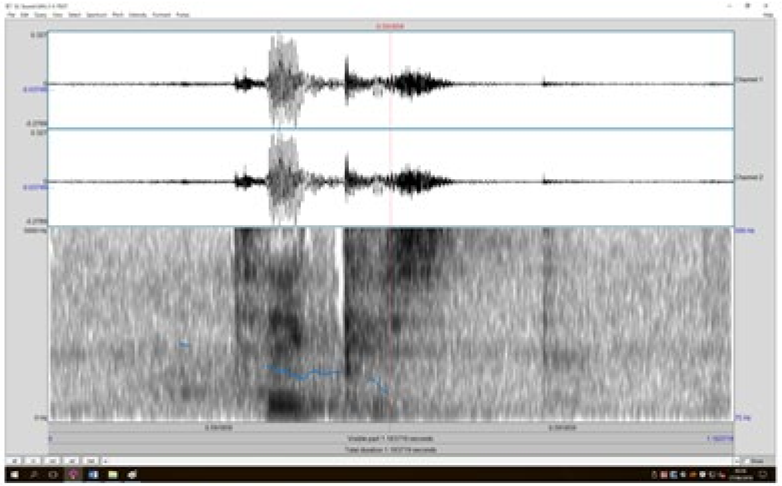
45 LWG2-16 [sik.ri:n]



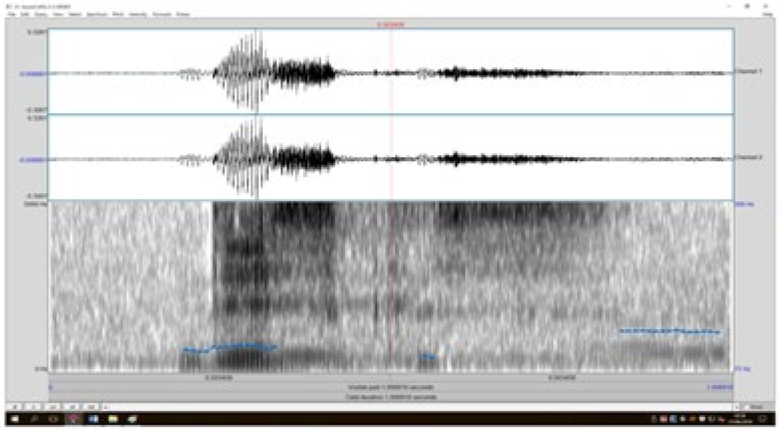
46 LWG2-7 [sik.ri:n]



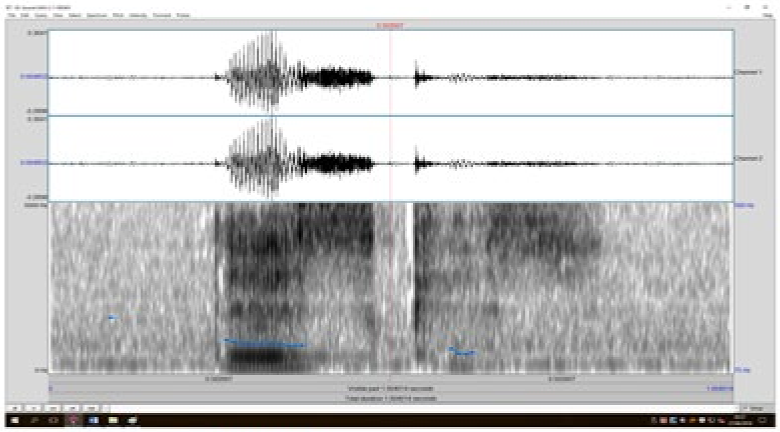
47 LWG2-7 [dɛs.kis]



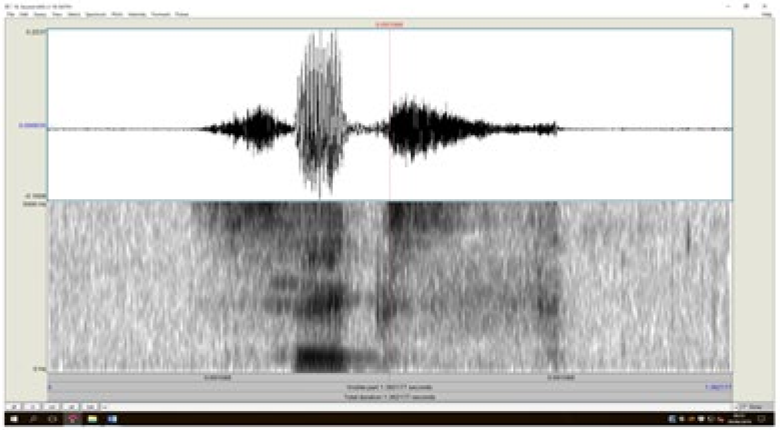
48 LWG2-5 [tɛ.kist]



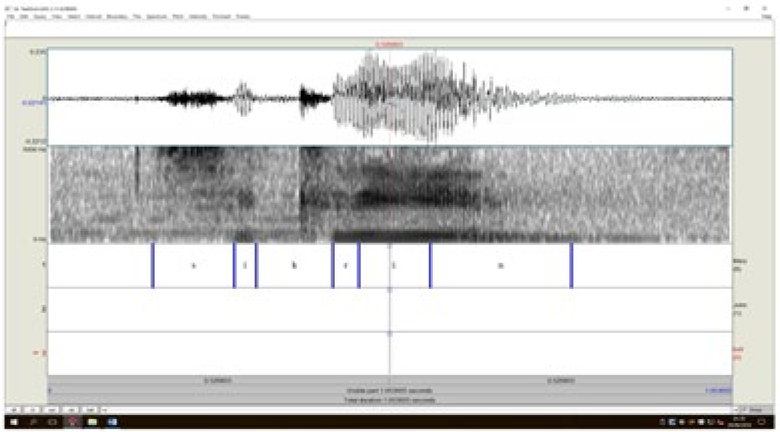
49 LWG2-3 [dɛs.kis]



50 LWG2-1 dɛs.kis]



51 LWG2-18 [sɪksθ]



52 LWG2-5 [sik.ri:n]