A sociophonetic description of Jordanian speakers of English living in Christchurch through different generations

Abdelkader M. Alshboul

Master of Linguistics (MLING)

Thesis

Submitted in partial fulfilment of the requirements for the degree of Master of Linguistics

in the College of Arts at the University of Canterbury

ACKNOWLEDGEMENTS

Table of Contents

Abstract

The current research supports the ongoing investigation into the role of the age of arrival in a foreign country as an important factor affecting not only immigrants' linguistic production but also production of the next generation. Such an investigation is conducted by exploring the production of Jordanian speakers of English living in New Zealand, particularly in Christchurch. The structure of the sample employed in this study provides more understanding about how a language can be produced differently by speakers that share heritage languages, regional, ethnic and religious backgrounds and are considered immigrants. More precisely, the present study examines the Jordanian vowel set of English, /t/s, and /r/s produced by three groups ("Fathers", "Younger children" and "Older children") living in Christchurch. Results of the research reveal that the New Zealand English vowel system was noticeable not only among the "Older children" and "Younger children" but also their "Fathers". Such a consequence shows that different vocalic features could be acquired regardless the speakers' age of arrival. Regarding acquiring the phonetic consonantal features (such as tap, glottal stop and linking /r/), they are constrained with particular phonological environments which are inevitably difficult to be acquired in the age of adulthood. Glottal stop and tap as variants of /t/ and linking /r/ as a feature of non-rhotic English varieties are clearly realised in the production of the Jordanian participants. These variants are particularly favourable into specific phonological environments which cannot highly likely be acquired by speakers who immigrated in their adulthood age while they are fundamental with their next generation. In other words, realising /t/s as a glottal stop and tap and linking /r/ within the [V_#C], [V_#V] and [V_#V] environments respectively is only favourable in the production of "Younger children" and "Older children" while they are almost absent in the production of the "Fathers" group. This evidently supports that the age of arrival is a key factor affecting the production of speakers whose heritage language is not similar phonetically and phonologically to the dominant language.

Chapter one

Introduction

Many studies have explored whether non-native speakers of English living in New Zealand (NZ) maintain their heritage languages and if, and how quickly, they learn English (Holmes, Roberts, Verivaki, & Aipolo, 1993; Revis, 2015; Roberts, 1999; Roberts, 2005). Other studies have focused on the English spoken by non-native speakers who live in English-dominant countries, and have investigated which linguistic characteristics are adopted. Nycz (2015) and Tagliamonte & Molfenter (2007) argue that only young speakers who arrive in a second language context at a young age can adopt not only the lexical and grammatical features of a dominant language but also its phonological features. Thus, when families move to a new country together, we often see older speakers using English to a reasonably advanced level in terms of lexis and grammar, but still having a noticeably "foreign" sounding accent. Younger speakers on the other hand, will adopt more native-like phonological patterns. Holmes et al. (1993) claim that there are many factors which could accelerate such a shift, such as re-ethnification and re-linguification. This means that minority groups attempt to adapt to their new environment by speaking the majority language and stop using their ethnic language. Further, they may practise different customs that relate more to those of the host community rather than their heritage customs. This, as a result, could lead future generations to create a new ethnicity and restructuring their linguistic features aiming the target community. Roberts (1999) points out that the Dutch languages shift to English in Wellington had been very marked in some of the third generation (grandchildren of immigrants). Her Dutch informants affirmed that there is a clear low language usage pattern among the third generation, which plays a main role in language shift to English. It means that their third generation members do not use their heritage language in their daily life which reflects their low language usage pattern to their mother tongue. Consequently, this apparently contributes to shifting to English. They also claim that even though their children's attitudes are positive toward their native language (i.e. Dutch), their language use is low. The trend of language maintenance and shift guided by Fishman and Holmes

among immigrants has been examined in depth in New Zealand (Holmes, Roberts, Verivaki, & Aipolo, 1993; Revis, 2015).

Immigrants encounter different problems through their immigration such as language difficulties, social contact, foreign currency, et cetera. Regarding language, they consider acquiring a dominant language in the host country an asset in which they can initiate their business with (Adamuti-Trache, 2013). However, acquiring such a language could be divided into two stages (language learning during adulthood or adolescence). Adamuti-Trache (2013) points out that those young speakers are more likely acquire the common language more easily. In other words, their conversations with native speakers in school, in their family, and within their social networks in their community, for example, may aid them to acquire the dominant language in a less effortful way. Regarding the adults, their acquisition correlates with different factors, which are their exposure to the dominant language, incentives for acquiring such a language, and efficiency in language acquisition (Adamuti-Trache, 2013; Holmes, Roberts, Verivaki, & Aipolo, 1993). Adamuti-Trache (2013) divides their language exposure into two stages which are pre-immigration and post-immigration. On the one hand, exposure to the host country language in the immigrants' native linguistic environment such as in school and daily life is a factor affecting their second language (L2) acquisition. She also adds that the level of similarity or difference between the host country language and their L1 (native language) is another important factor which could accelerate or slow down the process of L2 acquisition. On the other hand, their duration in the host country and how interactive and exposed to the majority language they are, are also considerable factors affecting their L2 acquisition. Finally, Adamuti-Trache (2013) argues that age of arrival is the most important influence affecting speakers' L2 acquisition. Holmes et al. (1993) state that 'rewards' such as getting jobs and promotions could play a main role in motivating them to interact and entrench the majority language in their production. They also add that immigrants' third generation evidently shifts to the dominant language. Such a claim also contributes to the importance of the age of arrival in the mechanism of language acquisition. Thus, Adamuti-Trache (2013), Hansen (2006), Holmes et al.

(1993), Roberts (2005), Tagliamonte & Molfenter (2007), and Nycz (2015) indicate the importance of age of arrival, level of education, and linguistic distance in affecting fluency in L2 acquisition. In the present study, the age of arrival will be investigated as a main factor affecting language acquisition.

Understanding how speech sounds change between those immigrants of the same regional, ethic and language background is an aspect which requires a deep understanding of the linguistic nuances of the language in question (Adamuti-Trache, 2013; Chambers & Schilling, 2012; Khalil, 2014; Nycz, 2015; Revis, 2015; Roberts, 2005; Tagliamonte & Molfenter, 2007). Nycz (2015) argues that many studies have been examining the mechanism of how young speakers convert their speech to include different phonological features of their second language/dialect. However, those studies did not address such an issue using participants of different ages belonging to the same family in their research sample. This means that using participants sharing similar factors such as regional, religious, and ethnic background, language, and age arrival is a key to understanding how a language could be produced differently in the same location. Thus, the current study will focus on three Jordanian groups (Fathers, Older children, and Younger children) living in Christchurch. Each group shares almost similar length of residency, the same heritage language (Jordanian) and regional and ethnic backgrounds. I selected (9) male educated subjects originally from Jordan. Eight of them immigrated to New Zealand while the last one was born in New Zealand. The informants were chosen based on two social factors (their age and gender). That means that the first three speakers are "Fathers" who immigrated to New Zealand when they were 30-45 years old. Their older children came with them when they were 13-15 years old. It should be pointed out that their English level was very limited when they arrived in New Zealand. Regarding the younger children, two of them were born in Jordan and moved with their fathers when they were one to two years old while the third one was born in New Zealand. The children in the youngest group were not exposed to their Jordanian heritage in the same way that the other groups were. The main concern of the present study is to examine the role of the age of arrival in Jordanian immigrants and to investigate to what

extent it affects their English production through examining their vowels, /t/, and /r/, to see if they are acquired identically/similarly/differently to the New Zealand English (NZE) speakers.

Though the age of arrival has been examined by many scholars whose concerns are addressing issues in a second language/dialect acquisition, little research has investigated how a language/dialect could be acquired and produced differently within speakers of the same family (Nycz, 2015; Tagliamonte & Molfenter, 2007; Wagner, 2012; Walker, 2014). Tagliamonte and Molfenter (2007) interviewed three Canadian-born children living in York, England. They examine the children's English production and conclude that the intervocalic /t/ and non-flapped variants which are found in York English are increasingly realised in the English of the Canadian born children. Acquiring such phonological features is an attribution to their age of arrival. Though they investigated the production of young speakers who were born in Canada and moved to England at a young age (under five years old), there was no discussion of how a second dialect acquisition could be acquired by adults (i.e. there was no information regarding the production of these children's parents). Nycz (2015) and Walker (2014) support a claim that acquiring different complex features of a dominant language variety can be achieved only at a young age. The younger the speakers, the more they could successfully acquire distinct complex phonological features of the dominant language. Such a discussion is supported by the study of Wagner (2012). She points out that understanding how language changes requires examining different social factors such as age, localities, and social class. In terms of age, she states that it is a main predicting factor reflecting different language features occurring in a particular place and time. She also adds that the native linguistic features are entrenched in the production of speakers at the beginning of adulthood. Such a conclusion can be found in the study of Gnevsheva (2015). Gnevsheva (2015) conducted a study examining the production of the Korean and German speakers of English in different situations. She pointed out that the Korean informants came to NZ at a very young age to stay either for a long time or permanently while the German speakers only came to study a postgraduate degree or to participate in distinct academic exchange programmes. She concluded that the phonological

9

features of German were apparently noticeable to her New Zealand English listeners when assessing participants' New Zealand English accent, whereas the high professional Korean participants were identified as more native sounding, especially in a services setting such as ordering fuel at a potential station. Such a conclusion could demonstrate that the exposure of the Korean speakers to NZE in the young age could contribute them to sounding more NZE native speakers than the German speakers. This result mirrors how the age of arrival influences the production of speakers.

1.1. Questions of the study

In order to examine the importance of the age of arrival, as discussed above, the current study will aim to address the following questions:

1.1.1. To what extent does the age of arrival (Fathers, Older children, and Younger children) affect the L2 production of immigrants?

1.1.2. To what extent are NZE vocalic features realised in the production of the subjects?

1.1.3. To what extent do speakers acquire the phonological constraints of the consonantal features [C_#V], [V_#V], and [V_#C]?

1.1.4. Which sounds are acquired similarly/differently to native NZE speakers?

1.2. Hypotheses

1.2.1. Vowels

1.2.1.1. The NZE vowel conventions will be the most noticeable vocalic system in the production of the "Younger children" and "Older children".

1.2.1.2. The "Fathers" group will be more likely to produce their vowels in line with the Jordanian Arabic vowel inventory (i.e. realising several vowels somewhere in their English production).

1.2.2. /t/

1.2.2.1. It is expected that when /t/ is intervocalic, it will be realised as a voiceless dental stop by the fathers group whereas it is more likely to be pronounced as a tap by both the younger and the older groups of children.

1.2.2.2.   /t/ will be realised as a voiceless dental stop in the production of the "Fathers"

group whereas it is more likely to be pronounced as tap in the "Older children" and

"Younger children's" production when it is intervocalic.

1.2.3. /r/

1.2.3.1.   I hypothesise that the "Fathers" group will produce their English in a rhotic pattern.

This means that /r/s will be pronounced post vocalically in instances such as 'far'.

New Zealand English is a non-rhotic dialect of English.

1.2.3.2.   I am also assuming that the "Older children's" English production will be less rhotic

whereas the "Younger children" generation will be more likely to acquire not only

the non-rhotic NZ English but also its features such linking /r/ and intrusive /r/.

Chapter two

Literature Review

2.1. Phonetic variation between Arabic and English vowel system

Many scholars have explored how the vowel system differs between English and Arabic (Ali, 2013; Alghamdi, 1998; Alotaibi & Meftah, 2013; Hago & Khan, 2015; Kalaldeh, 2016; Khalil, 2014; Saadah, 2011). Alotaibi & Meftah (2013), Hago & Khan (2015), Kalaldeh (2016), and Khalil (2014) point out that English syllables can be formed in a multitude of ways. Syllable forms consist of either an open syllable structure (CV or CCV) or a closed syllable structure (CVC, CCVC, CCCVC, CVCC, CVCCC, CCVCC, CCCVCC, CCVCCC, CCCVCCC, and CVCCCC). In Arabic, a syllable could also be open or close but not with such a wide variety of forms as in English (Alotaibi & Meftah, 2013; Kalaldeh, 2016). Alternatively, Saadah (2011) suggests that the Arabic vowel inventory is quantal. It only consists of six monophthongs, which are three short vowels with accompanying long-vowel counterparts (see Figure 1). English, on the other hand, is more complicated because it contains 12 monophthongs (see Figures 2), at least in some varieties, as well as diphthongs. Moreover, Alotaibi & Meftah (2013) and Kalaldeh (2016) indicate that a syllable in Arabic is repeatedly formed with a vowel in a syllable nucleus. Thus, it is possible to count the number of syllables in an Arabic word by counting the vowels. Furthermore, it is impossible for a syllable in the Arabic language to start with a vowel (Alotaibi & Meftah, 2013). Vowels can only occur between two consonants (interconsonantal) or at the end of a syllable or a word. This differs from the English language, where vowels can occur word or syllable initially, medially or finally. This means that English can have words that consist of a single vowel ("a", for example) (Al-Tamimi, 2007). In comparison, there is against Arabic linguistic constraints to have a word that consists of a vowel. Words are constrained by consonants in order to form a syllable or a word (Alotaibi & Meftah, 2013; Kalaldeh, 2016). Kalaldeh (2016) states that even pronouncing a vowel separately from a consonant would cause a production difficulty for speakers of the Arabic language. Kalaldeh (2016) and Khalil (2014) both attempt to investigate how the Arabic vowel system would affect the native Arabic speakers' English production. Kalaldeh (2016) examines

the production of Jordanian speakers of English in Jordan and notes what linguistic difficulties these speakers struggle with (which will be discussed in depth in the Jordanian vowel system, section 2.1.) Khalil (2014) compares Egyptian English to General American English in regard to the differing vowel systems. She finds that, unlike the General American English vowel system, the Egyptian English vowels produced by ten Egyptian adults could be found either at the end of a syllable, or between two consonants (which reflect similar findings in Alotaibi and Meftah's studies regarding locations of vowel system). Alghamdi (1998), Saadah (2011), and Khalil (2014) argue that the vowel quantity plays a significant role in distinguishing between Arabic and English varieties. Alotaibi and Meftah (2013), Saadah (2011), and Khalil (2014) all note that the tenseness and laxness of vowels between the English and Arabic vowel systems vary significantly. In English, producing vowels requires more tension by the tongue than in Arabic. In other words, the vowel duration is affected by how tense that vowel is. English, unlike Arabic vowels, requires more tension of the tongue muscle when producing vowels as a result of its vowel magnitude (e.g. Alghamdi, 1998; Alotaibi & Meftah, 2013; Khalil, 2014). Munro (1993) indicates that there are fewer diphthongs in Arabic than in the English language, which reflects in a prominent distinction between non-native Arabic speakers of English and native English speakers when both produce English. Munro tested five Jordanian speakers of English and discovered that a minority of Arabic speakers could not be identified as a non-native English speakers while the others demonstrated more identifiable Jordanian Arabic features in their English production. Different Arabic vocalic features were prominently realised in the production of the Jordanian adult speakers of English which reflects a different accent to the American English.

Figure 1: represents the vowel space of the Arabic language (Huthaily, 2003, p. 30)
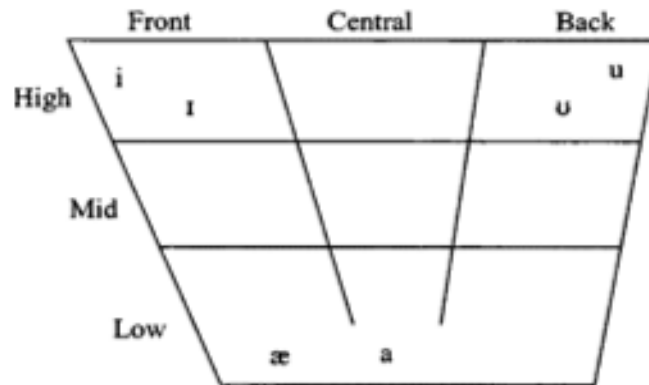
Figure 2: represents the vowel space of the English language (Huthaily, 2003, p. 35)
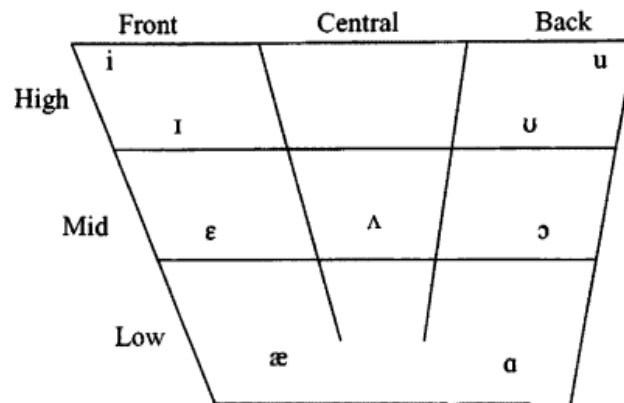
2.1.1. Jordanian vowel system

A few research studies have been conducted to investigate the Jordanian Arabic vowel system (Al-Tamimi, 2007; Kalaldeh, 2016). Kalaldeh (2016) carried out research investigating the difficulties Jordanian speakers of English are challenged with when producing English. More specifically, she shed light on which phonetic errors Jordanian speakers of English in Jordan make when producing particular English consonants and vowels which are not in their Arabic system. She noticed that the merging of several English vowels was rather prominent. For instance, she pointed out that KIT & DRESS and THOUGHT & GOAT were produced similarly to /e/ and /o:/ respectively (Wells, 1982). Another difficulty that Jordanian speakers of English struggle with is consonant clustering. She states that /ɪ/ and /e/, as shown in Figure 3, are the epenthetic vowels Jordanian speakers use to break

down consonant clusters. The LOT vowel, Kalaldeh (2016) indicated, is realised as /ɐ/, which is similar to the Received Pronunciation (RP) LOT vowel (/ɒ/). Al-Tamimi (2007) explored the phonetic variation within the vowel inventory between two dialects of the Arabic language: Jordanian Arabic and Moroccan Arabic. He observed that the vowel system in Jordanian Arabic consists of eight monophthongs:/i:/, /i/, /e:/, /a:/, /a/, /o:/, /u:/, and /u/, whereas the Moroccan vowel system is smaller: /i:/, /a:/, /u:/, /u/, and / ə/. In conclusion, it seems that the vowel system of Jordanian Arabic is distinctive in comparison to not only to the English language but also other Arabic language varieties.

Figure 3: Jordanian English monophthongs as produced in Jordan (Kalaldeh, 2016, p. 397)
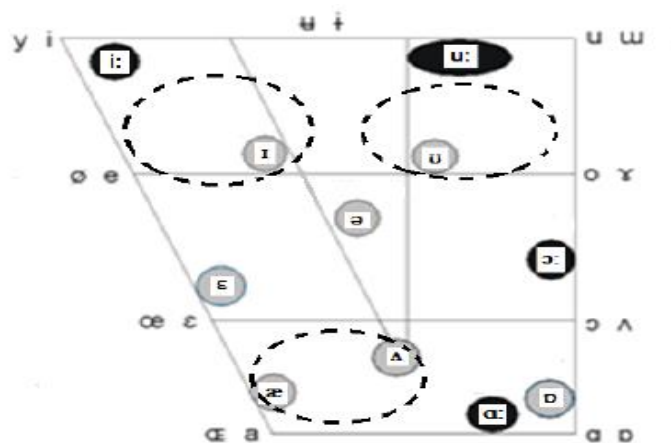
2.1.2. NZE vowel system

Within New Zealand, many different phonological changes occurred at the end of the nineteenth century that resulted in the formation of a new dialect New Zealand English (Watson, Maclagan, & Harrington, 2000). One of these changes was the shift of short front vowels, which resulted in a unique vowel system in comparison to other varieties of English (e.g. Bauer et al., 2007; Watson et al., 2000). Bauer et al. (2007) investigated the NZE consonants and vowel system. They stated that New Zealand English is similar to RP and Australian varieties in terms of the vowel system. However, there are still several distinctive features which distinguish NZE from other Standard English varieties (such as RP, and General Australian English). Such variations also appear to produce the KIT vowel in a centralised position both in unstressed and stressed syllables. This is sometimes articulated as the

commA vowel in the vowel trapezium (Bauer, et al., 2007; Watson, Maclagan, & Harrington, 2000). Bauer et. al also claim that the NEAR and SQUARE diphthongs converge in New Zealand English to be realised as homophones among young speakers (see Figure 4). Watson et al. (2000) argue that there is vowel raising in the DRESS and TRAP vowels which could aid in discriminating NZE from other English varieties. New Zealand English shares considerable similarities with other varieties of English in terms of vowel phonemes. For instance, the START vowel (which is produced in front of a central quadrilateral) is similar to the START vowel in Australian English. This attribute is one of many features which correlate NZ English and Australian English, resulting in confusability for non-native listeners to both dialects (Hay, Maclagan, & Gordon, 2008). However, Hay et al. (2008) argue that even this similarity could vary. There are a group of words which in NZE could be produced with the START vowel, yet are produced as the TRAP vowel by the Australian speakers such as *dance* and *chance*. Warren (2017) examines the relations between vowel quality and vowel duration in a five vowel pairs: DRESS & FLEECE, FOOT & THOUGHT, STRUT & START, and KIT & NURSE in the NZ English. He states that although STRUT and START vowels overlap across different English varieties such as NZ English, Singaporean English, Fijian English, and Malaysian English, NZ English is still distinct. The STRUT and START vowels in Singaporean English, Fijian English, and Malaysian English varieties are more likely to be produced as back vowels while they are produced as front vowels in NZE, similar to the Australian English. Warren mentions that there is still a difference between some NZE and Australian English vowels in regard to the vowel length. In terms of the DRESS and FLEECE vowels, he points out that there is a prominent and progressive raising of DRESS towards FLEECE, which is reflected via an obvious overlapping of the three age groups mentioned in his study (old-age, mid-age, and young-age). He also adds that KIT and NURSE clearly overlap in the production of both sex groups, particularly in the male speech production. He points to a salient difference between both of these vowels which refers to rounding lips and vowel duration for the NURSE vowel. Finally, he demonstrates that FOOT and GOOSE overlap more than FOOT and THOUGHT. It is

highly likely that variation between the NZE vowels could be attributed to the vowel quantity, rather than the vowel quality.

Figure 4: representS the NZE vowel space as shown in (Bauer, Warren, Bardsley, Kennedy , & Major, 2007, p. 98)
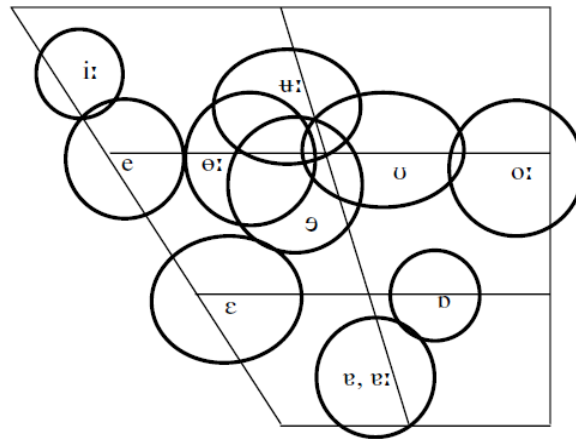
Vocalic variation could, as discussed above, play a significant role in differentiating between speakers of such varieties. Alghamdi (1998) points to vowel conventions as an effective means of discriminating between English and Arabic languages. This means that vowels which are clearly distinct between such varieties will contribute to identifying speakers' dialects/languages when Arabic speakers, for example, attempt to produce their L2, English. He also points out that speakers are more likely to transfer the phonological system of their first language (L1) when they produce their second or foreign language (L2) (Alghamdi, 1998). Such a claim is also argued by Hansen (2006). He states that the L1 phonological system is noticeable in speakers' L2 production. Moreover, Al-Tamimi (2007) argues that variation between languages in favour of vowel quantity could be the most significant issue in identifying a speaker's L1. Natour et al. (2011) also claim that racial backgrounds could be estimated based on the values of formant frequencies. Alghamdi (1998), Hago and Khan (2015), and Natour et al. (2009) all indicated that the geographical factor as part of dialectal variation could play another role in affecting the human voices, in terms of acoustic features. Ahuja and Vyas (2016) and Alghamdi (1998) state that acoustic features of dialects which are used in speech could reveal speakers' L1 regions. Furthermore, shifting to a dominant language

could lead to a number of phonological aspects such as assimilation, dissimilation, sound addition, sound deletion, metathesis and so on (Al-Ghalban, 2014). It means that contact with speakers from other societies where the dominant language is not similar to those speakers may contribute to different phonological changes in their native language, especially from the third generation (Holmes, et al., 1993; Roberts, 2005). Al-Ghalban (2014) provides English as an example to such a change. She states that different phonological and phonetic changes occurred when English merged with other languages such as Danish and French. She also proposes that this merge would occur with contact across all languages.

2.1.3. The similarities between the NZE and Jordanian Arabic vowel systems

Although there are many differences between the Jordanian Arabic and NZE vowel systems, several similarities are still noticeable between both of these language varieties. For instance, /i:/ produced by Jordanian English speakers in Jordan, as depicted in Figure 3, occurs in the right top corner of the trapezium, identical to its NZE counterpart, as seen in Figure 4. /ɪ/ also seems identical in both NZE and Jordanian English produced in Jordan. Bauer (2007) and Warren (2017) confirm that the NZE KIT vowel is very centralised. Such a feature is very visible in the production of the Jordanian English speakers living in Jordan (Kalaldeh, 2016). The BATH vowel also shows similarities between the NZE and Jordanian Arabic vowel systems. Al-Tamimi (2007) reveals that /a:/ in the Jordanian Arabic is low and central which is similar to its NZE counterpart. However, Bauer et al. (2007) affirm that the BATH vowel overlaps with the START vowel in NZE which is not the case in the Jordanian Arabic. This overlap supports the fact that NZE is a non-rhotic English variety. On the other hand, Jordanian English is rhotic (Kalaldeh, 2016), leading to different realisations of BATH and START.

2.1.4. Measuring formant frequency 1 & 2

In order to achieve one of the main goals of this study regarding the variation between Jordanian English and New Zealand English vowel systems, I measured values of the midpoint of the first two formant frequencies (F1 and F2). These formants have been used in the past as a standard measurement to examine variation between New Zealand English and other varieties (Hay, Maclagan, & Gordon, New Zealand English, 2008). Moreover, many scholars point out that the first

two formants are essential in illustrating the configuration of vowel conventions as a means of comparison across different language varieties (Ahuja & Vyas, 2016; Al-Anani, 1999; Ali, 2013; Khalil, 2014; Kulshreshtha, et al., 2012; Natour et al., 2011; Tahiry et al., 2016; Thomas, 2011; Xue et al., 2006). Khalil (2014) mentions that comparison between Egyptian English and General American English using the formant frequency contours resulted in clear cut evidence regarding the distinctiveness of Egyptian English and General American English varieties. In addition, it is highly useful to use the formant frequencies of F1 and F2 as a means of understanding the mechanism of the production of back/front and high/low vowels (Tahiry, Mounir, Mounir, & Farchi, 2016). Thus, formant frequency is a very effective acoustic parameter which could be used to examine variation not only between languages but also dialects.

2.2. /t/

There has been substantial research surrounding the realisations of /t/ in New Zealand English (Bayard, 1990; Docherty, Hay, & Walker, 2006; Fiasson; Holmes, 1995; Holmes, 1994; Holmes, 1997; Taylor, 1996). For example, Bayard tested /t/ variation in word final position of NZE speakers within the formal speech environments of reading passages and word-lists (1990). His study argued that the variation was influenced by both social and linguistic factors. One of his conclusions was that the increase of the glottal stop among the young speakers instead of /t/ in the word-finally was a prominent phonetic feature. He also added that such a feature was more noticeable in a conversational context among working-class participants in comparison to an interview environment. One of the most important results in Bayard (1990)'s study was the frequency of the glottal stop among the young speakers, which increased noticeably over two years from (1985-1986) to (1987-1988). His expectation about the increase of the glottal stop in the word-final position among the young NZE speakers was later examined by Holmes (1994, 1995, and 1997). Holmes (1997) argues that /t/ in NZE could be produced in a number of manners, for example intervocalic voicing (t -> d) or glottal stop (t -> ?). She, like Bayard, suggested that social and linguistic effects were the principal factors affecting realisations of /t/. Regarding the intervocalic t-voicing, it was

found to be more commonly realised within an informal speech environment, and less apparent among the more educated and professional speakers. Holmes (1997) postulated that two aspects could be affecting this: either a biological phonological phenomenon, or the spread of American English in NZE. In regard to the glottal stop, Holmes (1995; 1997) investigated how NZE speakers produced /t/ in word-finally through the extraction of conversations and formal interviews from the Wellington Corpus of Spoken New Zealand English (WCSNZ). She suggests that this sound more likely exists in NZE as a result of the British settlement in New Zealand. Her data were based on a variety of factors: age groups: (18-30 year-olds and 40-55 year-olds), gender, and social class (working and middle). Her results showed that /t/ could be realised as either a glottal stop or an aspirated /t/. The glottal sound was, as she revealed, constrained with a particular phonological environment (followed by a consonant or a pause and preceded by a vowel). She added that such the variation differed based on different social, style, and linguistic contexts. Her findings demonstrated that the glottalized /t/ was more widespread among the younger speakers (18-30) than the older speakers (40-55 years old) through the conversational speech. 14% of her middle-aged sample produced the glottal stop while 24% of the young-aged group produced the glottal stop, which could indicate an increase among the young NZ speakers. Holmes (1995; 1997) suggested that the glottal stop among the NZE speakers perhaps originated from different varieties of British English, such as London speech style. More interestingly, the glottal stop seemed to shift amongst the middle-class NZE speakers. Such a pattern could mirror that New Zealand English speakers prefer Received Pronunciation (RP), which includes a glottal stop in the word-final position instead of /t/ conditionally before a vowel (Holmes, 1995; 1997, p. 21; Wells, 1982). Finally, she concluded that the occurrence of such a salient aspect of British speech is increasing in the production of young NZE speakers. Docherty et al. (2006) argue that the glottal stop has been increasing among younger NZ speakers in comparison to the results of Holmes's (1995) and Bayard's (1990) studies. They discuss that NZE /t/ could be realised with distinct phones such as canonical /t/, fricative, affricate, and glottal stop. What is more, different social and linguistic factors such age, gender, CELEX frequency,

local frequency, and so on are taken into their consideration through their data analysis. Docherty et al. (2006) show that social aspects play a main role in affecting the various realisations of /t/ in the phrase-final position. In particular, their findings have shown that the glottal stop in the phrase-final position is more common in the production of young New Zealanders (particularly non-professional males), in comparison to professional males and females in general. Such a result aligns with Taylor's (1996) study which concluded that glottal stop instead of canonical /t/ is more common among heterosexual males than females and homosexual males. Docherty et al. (2006) also challenged the view that females led the change from canonical /t/ to a glottal stop, a suggestion posited by Holmes in 1995 Lexical frequency, plays another important role in the production of /t/. That means that frequent words were found to be more likely to include less standard forms while the low frequent words were discovered to be highly likely correlated with more articulated forms. However, such an over-generalisation could not blindly be applied on the whole to high frequent words containing phrase-final /t/, such as the word *let*, (Docherty et al., 2006). Such an aspect will not be addressed in the current research. It will be explored in the researcher's future study.

2.3. /r/

Investigating distinct issues regarding the mechanisms of rhoticity and how it is realised by native speakers of English has been a principal concern of many scholars (Bauer, 1984; Brown, 1988; Hay & Maclagan, 2012; Hay & Sudbury, 2005; Nagy, 2010; Wells, 1982). Non-rhotic environments are those where /r/ occurs post-vocalically yet is not pronounced. Dialects in which the /r/ is pronounced are deemed 'rhotic'. Hay and Sudbury (2005) explored the rhoticity levels in the production of native NZE speakers. They suggested that non-rhotic dialects are highly affected by two attributes (linking /r/ and intrusive /r/) which will be explained in depth later. Further, rhoticity has been examined in the context of the difficulties facing speakers who are learning a second/foreign language (Hamzah, Nashuha, & Abdullah, 2017; Kissling, 2013). One of these difficulties is when the native language is not rhotic, such as Chinese speakers who learn a rhotic variety of English or non-rhotic English speakers who learn Spanish (Hamzah, Nashuha, & Abdullah, 2017; Kissling, 2013). Such on-going

research has been attempting to address such issues by providing insight in terms of how rhoticity could be phonetically learned. However, there is a prominent lack of research regarding the adaptation process of rhoticity produced by immigrants living in an environment where immigrating non-native speakers of rhotic language varieties move to a place where the dominant language is non-rhotic and spend most of their daily lives in this non-rhotic environment. In particular, the acquisition of non-rhotic features (linking /r/ and intrusive /r/) by non-native rhotic speakers has not yet been explored in depth.

Regarding NZ English, Hay and Sudbury (2005) indicate that the NZ English is a predominantly non-rhotic variety of English. As mentioned above, such a feature is affected by two attributes (linking /r/ and intrusive /r/) which have the potential to be realised as more r-full or r-less in a particular boundary to reflect /r/ sandhi. Hay and Sudbury (2005) and Hay et al. (2008) distinguish between both of these attributes (linking /r/ and intrusive /r/). They state that if /r/ orthographically exists across a word boundary such as [far away], then it reflects a word-final linking /r/, while if it is across morphemes such as [daring], then it mirrors a word-internal linking /r/. Intrusive /r/ occurs in the same environment of linking /r/ but it is not present orthographically, such as in the words *ma and ba* where intrusive /r/ can be inserted between the final vowel of the first word and the initial vowel of a second word, for example in the phrase 'Ma and Pa' [maːɹənpaː] or across a morpheme boundary like *clothing* which can be pronounced as [klɒɹθɪŋ]. As mentioned previously, /r/ sandhi could be realised in two distinct sounds (i.e. full /r/ or less /r/) (Hay & Sudbury, 2005). This leads Hay and Sudbury (2005) to account for various phonological theories in terms of the phonological environment of /r/ sandhi. For example, they state that /r/ is normally retained or inserted in a syllable onset such as the word [*daring*]. Another theory where /r/ sandhi can be discussed is a proposed-rule inversion which mainly accounts for the intrusive /r/ when it comes into view. It means that non-rhoticity occurs generally when /r/ is preceded by a consonant but it is maintained between two vowels even across a morpheme or word boundary such as *caring* and *far away* respectively. It is pointed out that it is not necessary to exhibit linking /r/ or intrusive /r/ if

dialects are non-rhotic. Wells (1982) points out that unlike other non-rhotic dialects, some dialects in the Southern US exhibit neither linking r nor intrusive r in their speakers' English speech. Further, linking /r/ or intrusive /r/ in such dialects can be variable across word boundaries. Hay and Sudbury (2005) claim that such variability in displaying /r/ sandhi leads to a discussion if such variability is attributed to via social or linguistic factors. Brown (1988) suggested that linking /r/ seemed to have a higher rate of occurrence than intrusive /r/ in dialects which may reflect a kind of stigmatization. Other studies also found that linguistic and social factors play main roles in displaying /r/ sandhi (Brown, 1988; Joseph, 1999; Wells, 1982).

Chapter three

Methodology

3.1. Participants:

In the present study, nine male Jordanians living in Christchurch were interviewed. Their ages varied between 14- 60, however the participants were stratified into three age groups. The first group were fathers who came to NZ around 15 years ago at the time of conducting the present study. All of them came as educated immigrants aged between 30-45 years old. Some of them had been working in Christchurch for almost 10 years. The second group was older children who were born in Jordan and shifted to NZ to join their families when they were 13-15 years old. Most of their lives were spent in different places in NZ, although mainly in Christchurch. All of these participants had completed bachelor's degrees at the University of Canterbury by the time of this study. Finally, younger children were the third group, who were born either in Jordan or in NZ. In particular, one of them was born in NZ while the other two were born in Jordan and came when they were one to two years old. All of them had lived in NZ for most of their lives. Two of them can speak very little Arabic and affirm that their native language could well be English. Regarding their level of education, two of them are at secondary school, while the third informant recently completed tertiary education. Table 1 shows more details about the informants. The participants were selected based on a network approach of a friend of a friend technique (Chambers & Schilling, 2012, p. 26; Milroy & Milroy, 1985). Chambers and Schilling (2012) and Milroy and Milroy (1985) indicate that such a technique was effective in collecting adequate data for their research. All of the participants in this study used English in their daily life with at least an intermediate level of English proficiency. The participants were provided with consent forms and information sheets to be signed as an interview requirement at the University of Canterbury. Precisely, I provided two consent forms (one for the adults and one for the children). At the beginning of the interviews, I asked the participants to sign them as a clear agreement that they agreed freely to participate in the project. Then, I asked them

to introduce themselves and discuss a variety of issues. All of the interviews were conducted either at their houses or in a sound booth in the Canterbury University in Christchurch, NZ.

Table (1): the participants' information

Generation	Age of arrival	Their current age	Speaker
Father	42	60	Speaker 1
Father	32	47	Speaker 2
Father	35	51	Speaker 3
Older children	13	34	Speaker 4
Older children	14	34	Speaker 5
Older children	15	35	Speaker 6
Younger children	1	15	Speaker 7
Younger children	born in NZ	15	Speaker 8
Younger children	2	23	Speaker 9

3.2. Materials

A Tascam was used to record the interviews in 16-bit resolution at 44,100 kHz. The same settings in the Tascam were carried out such as (choosing monochannel during recording the interviews and adjusting the sound quality to fit the participants` voice quality). The Beyer microphone was also used in order to elicit a very clear sound. The distance between the Beyer microphone and the participants` mouths were taken into consideration. The interviews started with a semi-structured interview where the participants talked about their daily life, preferred activities, as well as their lifestyle in NZ generally and particularly in Christchurch. Then, they were asked particular questions

which were designed to motivate the participants to speak as freely as possible in order to provide more acoustic data to the research. The collected data were then transcribed using Praat (speech processing software) (Boersma & Weenink, 2018). Later, the transcribed files were uploaded to the Language, Brain & Behaviour Corpus Analysis Tool (LaBB-CAT) to gain the data below (Fromont & Hay, 2008). LaBB-CAT is an online software tool developed by the University of Canterbury used to store recordings and their transcriptions (for more infromation see Fromont & Hay, 2008).

3.2.1. Vowel analysis

16116 tokens were extracted from LaBB-CAT that contained the 11 vowels of interest: FLEECE, KIT, TRAP, DRESS, commA, FOOT, LOT, STRUT, START, GOOSE, and FORCE. The CSV-file is uploaded onto the LaBB-CAT software again and several features were identified such as choosing F1 and F2 selecting the mid-point from the Widon offset (an option in the LaBB-CAT software). The "Run Batch" was selected to gain the formants. When the extraction was completed, I extracted the CSV-file from LaBB-CAT software which included the formant frequencies (F1 and F2). Although in NZE BATH & START and THOUGHT & FORCE vowels are treated as collapsed due to the non-rhotic nature of the accent, they are treated as separate in the current study as most of the participants are not native speakers of New Zealand English.

Vowels were normalized by using NORM (an online website) to determine the vowel spaces (for more information see Tyler & Thomas, 2007). More particularly, I uploaded the CSV-file including the first two vowel formants on NORM website. Then, different settings were selected: means for per speaker, Lobanov, per speaker on own plots, and no scale results. The values of formant frequencies (F1 and F2) were measured as main parts of the comparison between informants' production. Their English vowels were compared either to plots plotted by Bauer, Warren et al., (2007), Gnevsheva (2015), and Warren (2017), which reflected different vocalic features of NZ English or to plots plotted by Al-Tamimi (2007) and Kalaldeh (2016) which described the Jordanian Arabic and English vocalic features. This is conducted to determine which productions

they are close to. Finally, I used the lexical sets of Wells (1982) to describe different acoustic features of vowels.

3.2.2. /t/

In the current study, /t/ is classified into four variants. The first variant is [t] when it is fully articulated in a plosive or affricate manner as seen in Figure 5. The second variant is a tap (as shown in Figure 6) while the third form is t-dropping which is clear in Figure 7. The fourth form is a glottal stop which could be identified when there is a visible gap of plosive and no burst in the spectrogram, as seen in Figure 8, (Fiasson, 2016). Where tokens were unclear, the spectrograms were inspected, otherwise, auditory analysis is an effective and efficient method of distinguishing between the variants of /t/ in the word-final position of the participants' speech. I looked for particular environments: [V_#V], [V_#C], and [C_#V]. The [V_#V] environment reflected a two word boundary where the first word ended up with /t/ preceded by a vowel and followed by a vowel of the next word such as (*lot of*). The [V_#C] environment referred to a word with word-final /t/ preceded by a vowel while the next word began with a consonant such as (*at home*). Finally, the [C_#V] is an environment where the first word ends up with /t/ preceded by a consonant and followed by a vowel of the next word such as (*honest and*). In order to extract /t/ in the word-final position, all of the layered searches of all nine informants were selected. Then, the following searches were performed:

3.2.2.1. [V_#V] 314 tokens were extracted. Seven had to be deleted as they were filler words and did not fit the criteria. As a result, 307 tokens were analysed.

3.2.2.2. [C_#V] 189 tokens were extracted. I deleted all tokens of underlying /d/. 126 tokens were analysed.

3.2.2.3. [V_#C] 685 tokens were extracted. 106 tokens were deleted because they were followed by fillers such as *mmm, hhh, rr,* and so on. Thus, the net tokens in such an environment were 579.

Figure (5): Representing [t] in the production of the participants.
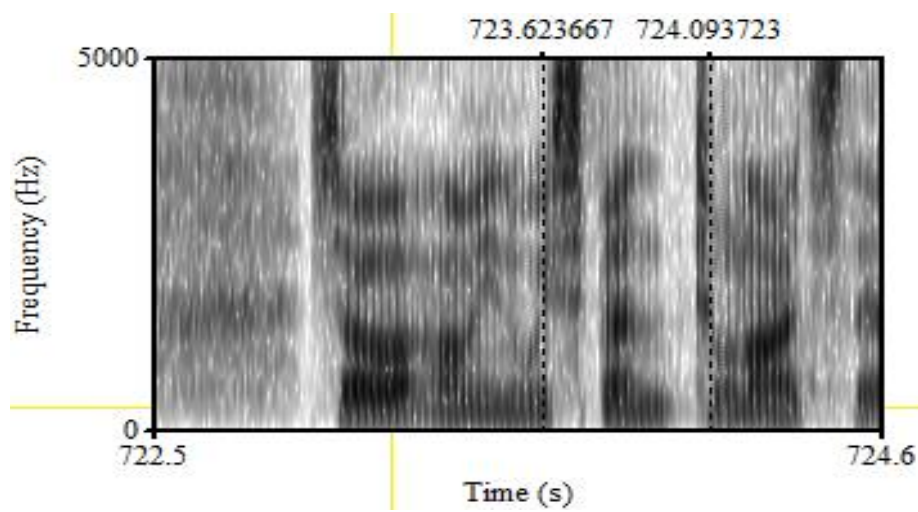
Figure (6): Representing tap in the production of the participants.
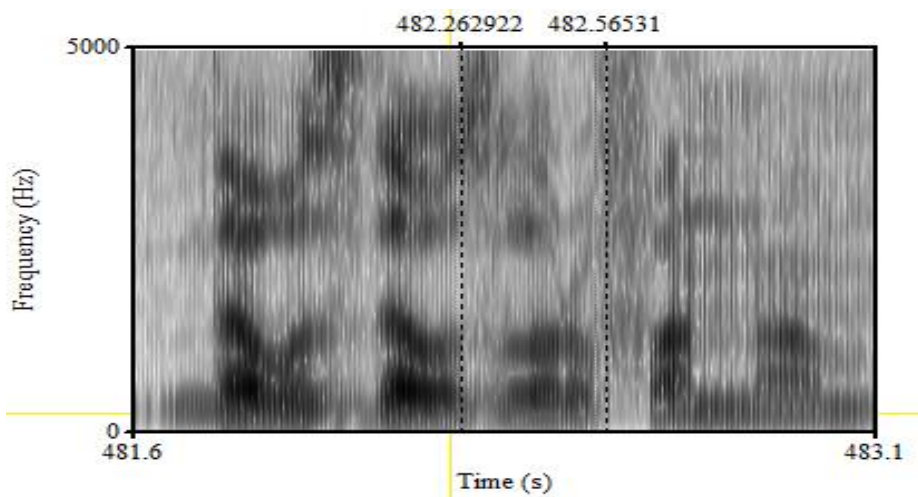
Figure (7): Representing t-dropping in the production of the participants.

Figure (8): Representing the glottal stop in the production of the participants.

3.2.3. /r/

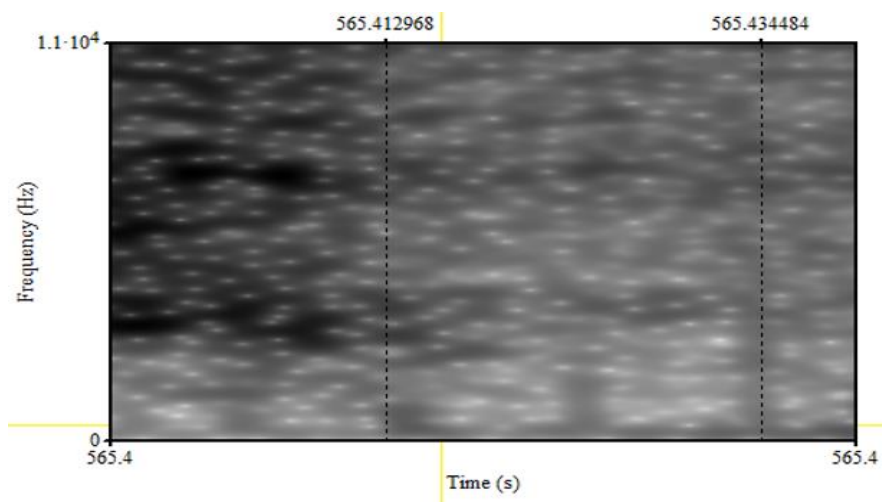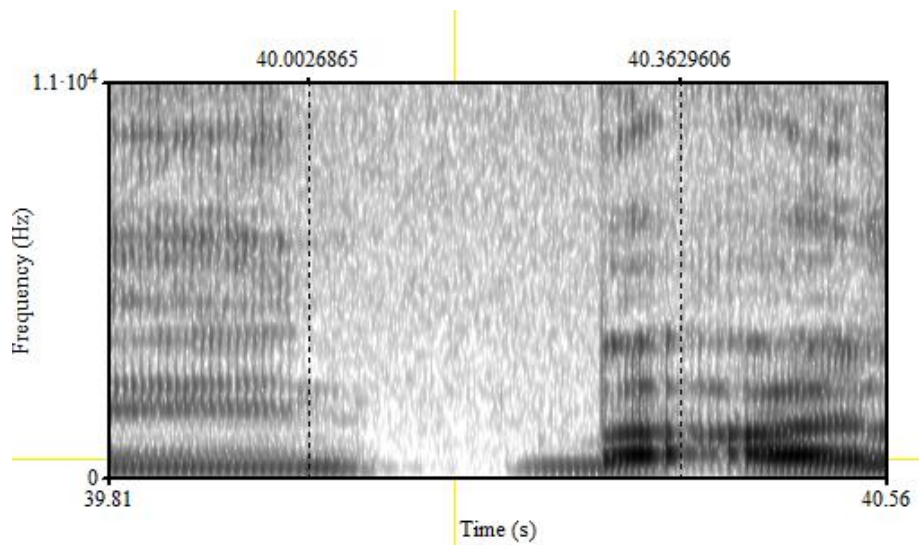In order to obtain all of the /r/ tokens, linking /r/, and intrusive /r/ through the LaBB-CAT software, different settings were carried out. For the canonical /r/, I set up the Set Search Matrix on the orthography option, selecting across one word boundary. In regard to the regular expressions box, I set up the orthography box with the command (**.*r|.*re**). I selected "**only search transcripts for which these are the main participants**" and "**only match words that are aligned**" with showing "**1 word before/after each match**". 1210 tokens were collected. Regarding intrusive /r/, I selected phonemes and orthography options across two-word boundaries from the Set Search Matrix. I inserted the below command in the phoneme slots:

.*[^all of the consonants]   followed by   **[^all of the consonants].***

and I inserted **[all of the consonants] [all of the consonants]** into the orthography slots. Then, the options (**only search transcripts for which these are the main participants** and **only match words that are aligned**) were selected within one word before and after of each match. I then extracted a CSV excel file in order to perform the analysis. As with /t/ tokens, the analysis was conducted auditorily. Variants were coded with /r/ or Ø to reflect the presence or absence of /r/. Regarding the intrusive /r/, I checked an environment across two word boundary where the boundary sits between

29

two vowels (word final and word initial) using the LaBB-CAT software settings mentioned above. In total, there were only 12 instances where the intrusive /r/ could be expected to occur, 257 instances where linking /r/ could occur and 953 tokens with any other word final /r/. Due to insufficient data regarding intrusive /r/, the current research will only shed light on the production of /r/ or Ø and linking /r/ within the three age groups of Jordanian-moved-New Zealander participants

3.3. Data Analysis

Statistical analysis was performed using RStudio. More precisely, different tests were carried out to tease out the differences in vowel production across groups. I examined the DRESS, TRAP, and KIT vowels. These vowels were selected due to their salience within the NZE accent. Warren (2017) discovered that the DRESS, TRAP, and KIT vowels could be used to identify NZE. After testing a variety of linear regression models, a linear model fitted to the data indicated that F2 of the DRESS vowel showed a significant difference between the groups (discussed in depth in section 4.1.2). In terms of consonantal features, I discovered that the logistic effect regression models were the best-fitting analysing the potential use of the realisations of /t/s ([t], glottal stop, tap, and t-dropping), rhoticity, and the linking /r/. Regarding /t/, [t] as a variant instead of /t/ was explored through the interaction model while the other variants (glottal stop, tap, and t-dropping) were addressed using mixed effects models. In terms of /r/, the best fitting model was the interaction model. The p-values provided into the present study demonstrate the likelihood ratio test of the whole models.

Chapter Four

Results

In this section, the data collected, transcribed, and analysed by Praat, LaBB-CAT software and R are analysed as follows. First, the vowels of each speaker are described individually to show to what extent their vocalic production is similar/different to NZE/Jordanian Arabic. Then, the /t/ tokens followed by the /r/ tokens will be analysed.

4.1. Vowel plots

4.1.1. Vowel description per individual

Figure 9 introduces the first Speaker 1's vowel space. He is a father aged 57 years old and came when he was around 42 years old. As shown in Figure 9, the FLEECE vowel is prominently produced similarly not only to the Jordanian Arabic FLEECE vowel plot but also to the NZE FLEECE vowel plot (Al-Tamimi, 2007; Bauer, Warren, Bardsley, Kennedy , & Major, 2007). The KIT vowel seems very close to the centre of the trapezium and a bit high to reflect also the Jordanian Arabic and NZE KIT vowel (Al-Tamimi, 2007; Bauer, Warren, Bardsley, Kennedy , & Major, 2007). The FOOT vowel is the highest in the trapezium in comparison to the other vowels and appears to be more in the front than typically realised for NZE speakers of the same age (Warren, 2017). The GOOSE, NURSE, and DRESS vowels are prominently produced in the centre of the Speaker 1's vowel space. The only difference between them is that the DRESS vowel is further back. The commA vowel is also centralised but realised further back compared to its NZE counterpart. The TRAP vowel is a low-mid back-mid vowel which is still similar to its Jordanian Arabic counterpart (Al-Tamimi, 2007). The STRUT and LOT vowels are produced identically (low-mid back) which are not similar to the NZE vowel system. The FORCE and BATH vowels are a bit fronter in comparison to the STRUT and LOT vowel plots but they are still produced similarly to each other. The THOUGHT vowel is articulated as a low central vowel which is not similar to its NZE counterpart. Finally, the START vowel is articulated in the corner (low back) of Speaker 1's vowel space which is also not similar to the NZE START vowel. As a result, though there are distinct phonetic features regarding the NZE vowel system, the Jordanian Arabic system is still the dominant feature in the production of Speaker 1.

Figure (9): Representing the vowel space of the Speaker 1.
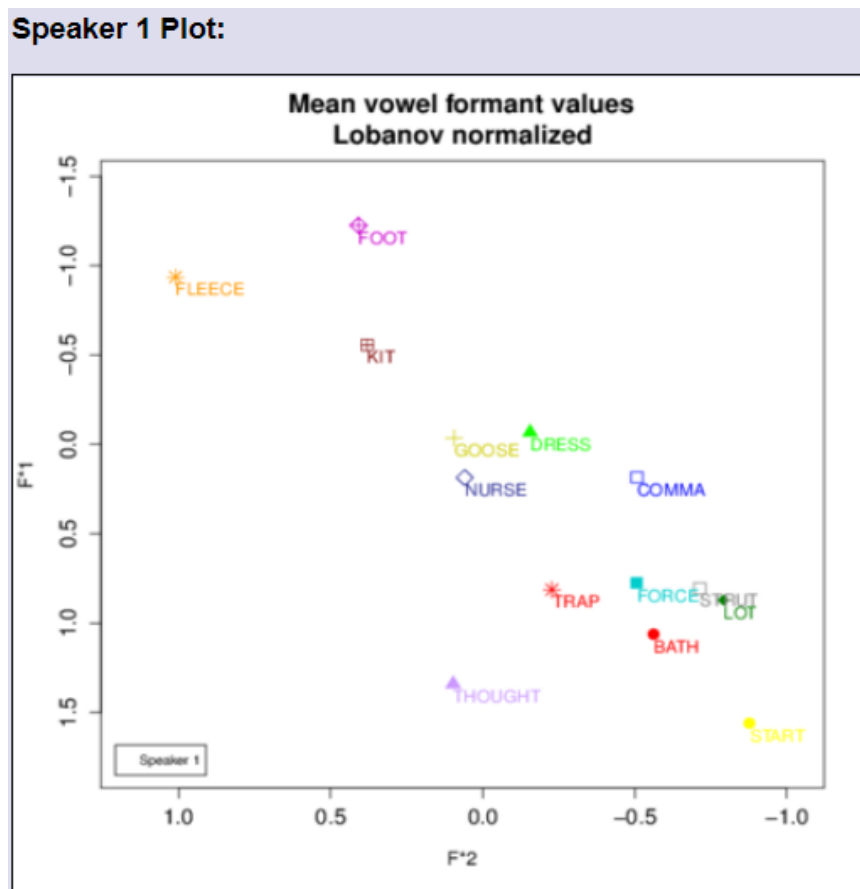
In Figure (10), it is apparent that the vowel space produced by Speaker 2, who is a father aged 47 years old, mirrors not only his heritage vowel conventions but also shows an influence of NZE vowels. Speaker 2 spent around seven years of his life in NZ with a native NZE partner. The FLEECE vowel, as expected is identically produced to its Jordanian Arabic and NZE counterpart where it is on the top left corner as plotted in (Al-Tamimi, 2007; Bauer, Warren, Bardsley, Kennedy , & Major, 2007). The KIT vowel is a bit lower and further back to the FLEECE vowel. The DRESS vowel is not produced similarly to the NZE counterpart. It is very central where it meets in the (0) point of F1 and F2. The GOOSE vowel, which is high central, is produced similarly to its NZE GOOSE vowel which reflects the impact of Speaker 2's surrounding environment (NZE). The FOOT vowel is also high and central (clearly overlapped with the GOOSE vowel) but it is pronounced differently to the NZE FOOT vowel which is high-mid and a bit back in comparison to the commA vowel. The NURSE vowel which

32

is high-mid central is very close to its NZE counterpart produced by Speaker 2's NZE equivalents (Warren, 2017). The commA vowel is also a bit central in the quadrilateral and similar to its NZE counterpart. The THOUGHT vowel produced by Speaker 2 is identical to its NZE counterpart produced by a NZE speaker aged 46-60 regarding F1 (central) and F2 (back). The LOT vowel is a bit higher in trapezium compared to the NZE counterpart where it is low-mid and very central but still very close. Kalaldeh (2016) points out that the THOUGHT vowel does not exist in the Jordanian Arabic vowel space and is produced differently by Jordanian Arabic speakers in comparison to other English varieties. She states that the Jordanian speakers of English living in Jordan produce the THOUGHT vowel as /o:/. The TRAP vowel (low-mid central) is similarly produced to the TRAP vowel in Jordanian Arabic as Al-Tamimi (2007) mentioned. The vowels which reflect the NZE vowel system the most in the production of Speaker 2's vowels are the START and STRUT vowels, which show the same position of their NZE counterparts. Moreover, the BATH vowel was realised close to the START vowel but not identical, which hints at the NZE BATH and START overlap. It is clear that the BATH vowel is produced as the same as its Jordanian Arabic counterpart (low central) which is still similar to the NZE BATH vowel plot. The STRUT vowel is not part of the Jordanian Arabic vowel system (Al-Tamimi, 2007). However, Figure 10 shows an apparent overlapping between the STRUT and BATH vowels. This more likely reflects that Speaker 2 does not appear to be by NZE regarding his BATH and START vowels.

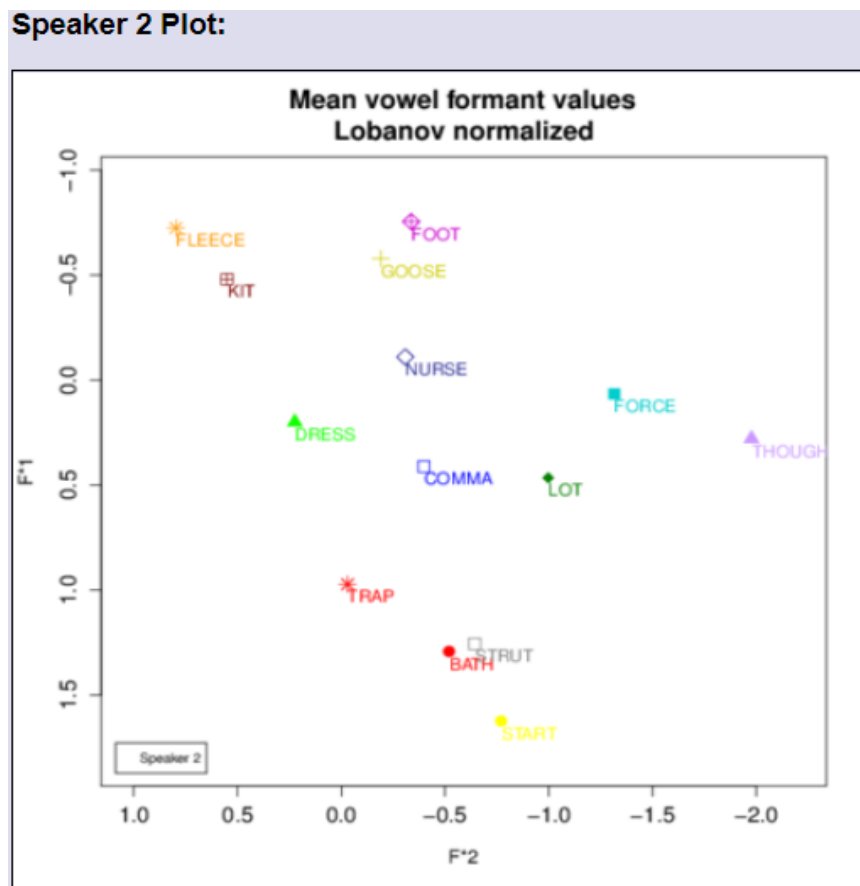**Figure (10)**: Representing the vowel space of Speaker 2.

Figure (11) shows the vowel space of Speaker 3 who was a father aged 51 years old at the time of the study. Speaker 3 had spent almost sixteen years in New Zealand. As Figure (11) illustrates, the FLEECE vowel is high front which is similarly to its counterpart in the NZE and Jordanian Arabic (Al-Tamimi, 2007; Bauer, Warren, Bardsley, Kennedy , & Major, 2007). The KIT vowel is very close to the FLEECE vowel which is unusual as this maps on to neither Jordanian Arabic nor NZE. The GOOSE vowel is identically produced as its NZE counterpart (high central), highlighting effect on his time in New Zealand. The DRESS vowel is central regarding F1 and F2 which is not similar to the NZE DRESS vowel (overlapped with the FLEECE vowel (Warren, 2017)). It is also clear that the NURSE vowel is produced similarly to the commA vowel (almost central) which is very similar to its NZE counterpart. Regarding the commA vowel, it is a bit backer compared to its NZE counterpart in an account of F1 but still central in terms of F2. The LOT vowel is similarly pronounced

to the NZE LOT vowel (low-mid back). The TRAP vowel is also central but a bit lower in comparison to the NURSE and commA vowels in the trapezium. The THOUGHT vowel is low-mid back which is similar to its NZE THOUGHT vowel. Another prominent feature reflecting the NZE vowel system in the production of Speaker 3 is the overlapping the THOUGHT vowel with the FORCE vowel (low-mid back) as plotted in Bauer, Warren, Bardsley, Kennedy , & Major (2007). The BATH vowel occurs between the STRUT and STRART vowels and is produced as a low back vowel. The STRUT and START vowels are clearly produced with the same vowel position as their NZE counterparts which indicates one of the main NZE vowel space features. Finally, the FOOT vowel is pronounced as the lowest vowel in the trapezium regarding F1 but still central in terms of F2.

Figure (11): Representing the vowel space of Speaker 3.
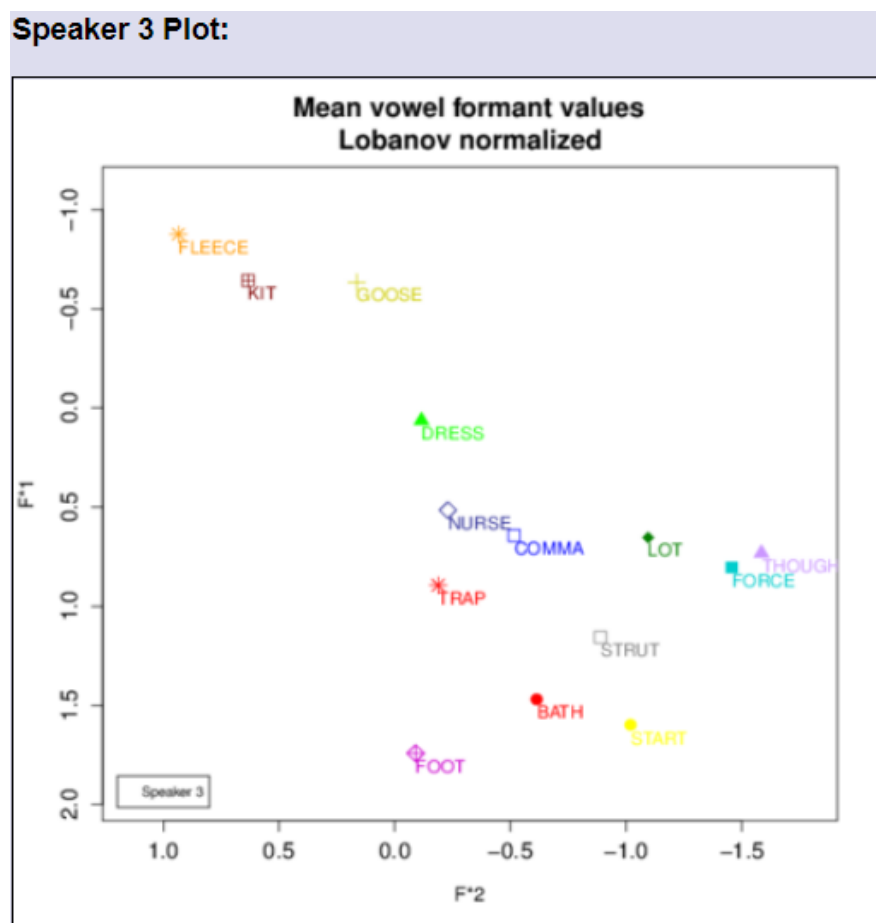
The vowel space shown in Figure 12 introduces the vowel plots of Speaker 4. Speaker 4, as seen in Table 1, is 34 years old at the time of conducting the current study. His age when he arrived NZ was 13 years old. As with the previous speakers, the FLEECE vowel is on the top left corner (high front) of the trapezium which prominently mirrors its counterpart in both vowel systems (Jordanian Arabic and NZE). The GOOSE vowel is identically produced as the NZE GOOSE vowel (high central). The KIT vowel is a bit lower and fronter compared to the GOOSE vowel in the vowel space seen in Figure 12. There is an obvious cluster of vowels in the centre of the vowel space (DRESS, NURSE, and commA). It is clear that the DRESS vowel is very close to the NURSE vowel which is not the same situation in the NZE vowel context (taking the consideration of the age (Warren, 2017)). The NZE DRESS is expecting to be close to the FLEECE vowel (Warren, 2017). The NURSE and commA vowels are similar to their NZE counterparts (central) as plotted in (Bauer, Warren, Bardsley, Kennedy , & Major, 2007). The THOUGHT vowel is central back which is similar to its NZE counterpart but not overlapping with the FORCE vowel, which partially conforms to Warren (2017)'s predictions regarding the overlap between FORCE and THOUGHT. The FORCE vowel, which merges with the THOUGHT vowel in the NZE, is obviously very close to the FOOT vowel plot in the trapezium. The FOOT vowel in the NZE vowel system overlaps with the GOOSE vowel, which does not occur in the production of Speaker 4. However, the overlapping in Figure 12 occurs in between FOOT and FORCE which is not similar to the NZE vowel inventory. The LOT vowel is very close to the centre from the back side and produced similarly to the NZE LOT vowel which is low-mid and back-mid (Bauer, Warren, Bardsley, Kennedy , & Major, 2007). The TRAP vowel is close to the centre which conforms to the results in Warren (2017) regarding TRAP-raising in NZE. There is an apparent merge between the BATH and START vowels for this speaker which are identical to their NZE counterparts. The STRUT vowel occurs in the same position of the NZE STRUT vowel. Another interesting feature mirroring the NZE in the production of Speaker 4 is the positions of the STRUT, BATH, and START vowels which are identical to their NZE counterparts'.

Figure (12): Representing the vowel space of Speaker 4.
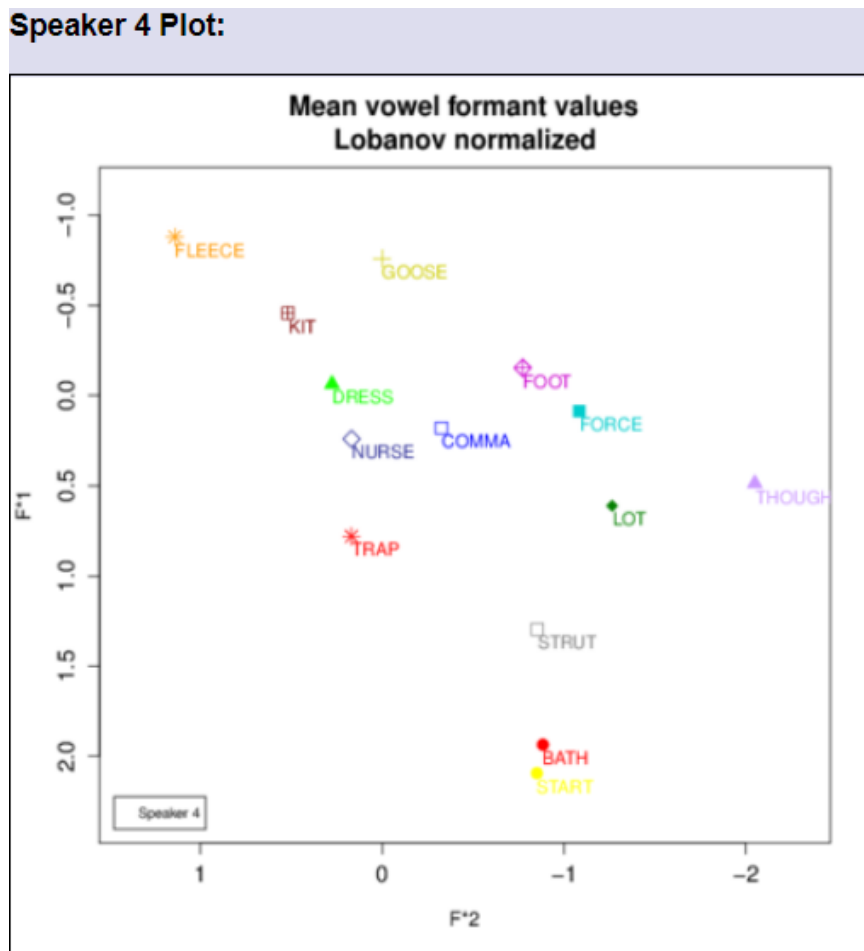
Figure 13 represents the vowel space of Speaker 5 whose age is 34 years old seen in Table 1.

He states that his English at the time of his arrival NZ was very limited. However, his vowel system

seems to reflect the expected NZE vowel system more closely than the other older group members.

The FLEECE vowel is high front in the trapezium to reflect both Jordanian Arabic and NZE. The

GOOSE and FOOT vowels are overlapping (high central) which are similar to the NZE vowel context.

Warren (2017) discuses such an overlapping between FOOT and GOOSE and points out that FOOT

more likely raises to become more similar to GOOSE than THOUGHT which can be seen in Figure 13.

The KIT vowel is very close to the centre and high which reflects not only the Jordanian Arabic but

also NZE. There is a cluster of vowel plots (DRESS, NURSE, and commA) in the centre. The DRESS

vowel is very central in the trapezium regarding F1 and F2 which is not similar to its NZE counterpart.

The NURSE vowel is also produced similarly to the commA vowel which could reflect the rhotic feature in Speaker 5's production more than the NURSE vowel itself. The LOT vowel which is central and back-mid is very close to the cloud (commA, DRESS, and NURSE). The THOUGHT and FORCE vowels which are central back are overlapped to reflect one of the main features of the NZE vowel system. The TRAP vowel is low-mid central which more likely shows its Jordanian Arabic counterpart. There is a clear overlap between the BATH and START vowels which are identical to their NZE counterparts. The STRUT vowel is a bit higher than the BATH and START vowels to mirror the vocalic positions of their NZE counterparts but it is also close to the Jordanian Arabic BATH vowel. Consequently, most of the vowels produced in Figure 13 prominently reflect different main features of the NZE vowel space.

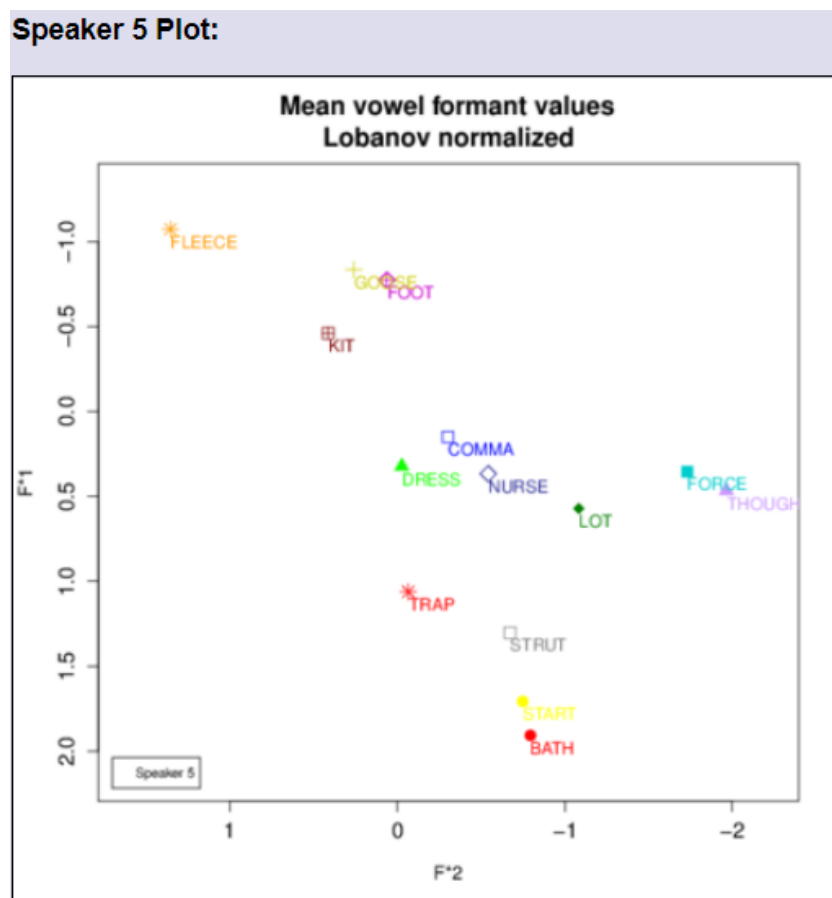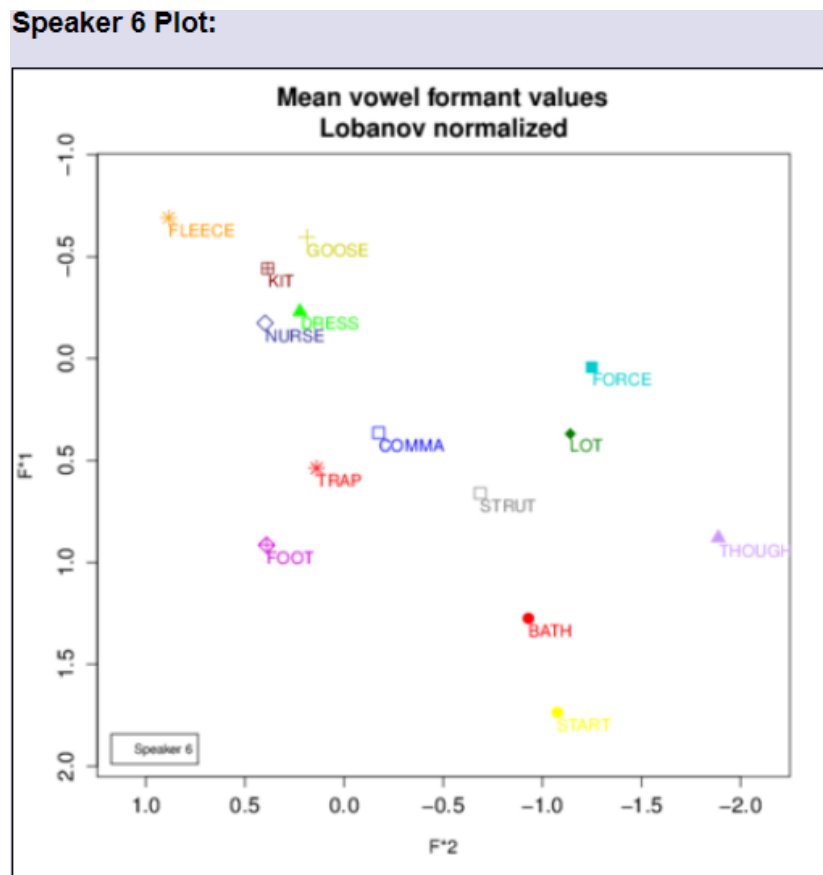**Figure (13)**: Representing the vowel space of Speaker 5.

Figure 14 introduces the vowel space of Speaker 6. His age was 35 years old when he was interviewed by the researcher. As with the other older speakers, it is clear that there are several similarities regarding the NZE vowel inventory in the vowel plots seen in Figure 14. The FLEECE vowel is clearly at the top left corner of the trapezium (high front) which reflects both vowel systems (Jordanian Arabic and NZE). The KIT vowel, which is central, is surrounded by the GOOSE, NURSE, and DRESS vowels. The GOOSE vowel is high central which reflects the NZE GOOSE vowel. The DRESS is very high, which reflects one of the main features of the NZE vowel system but a bit backer regarding F1. The commA vowel is produced centrally in the trapezium and very far from the NURSE vowel. The TRAP vowel is a bit lower and fronter compared to the commA vowel but still close. This could converge with the NZE TRAP which is raising toward the central posture in the NZE vowel trapezium discussed by Warren (2017). The THOUGHT vowel is not identical to its NZE counterpart but still back. The FORCE vowel is produced as high back-mid which is not similar to the NZE FORCE vowel. The LOT vowel is a bit fronter in comparison to the THOUGHT vowel which is also not similar to its NZE counterpart. The STRUT (almost central) is far from the BATH and START vowels. The BATH vowel is low-mid and almost central and produced differently to the START vowel. The BATH and START vowels are merged and produced as one sound, as in NZE. Al-Tamimi (2007) reveals that the BATH vowel in the Jordanian Arabic vowel magnitude is the lowest and most central vowel in the trapezium which is in contrast to the low-mid back-mid in the vowel space of Speaker 6. The FOOT vowel is produced as a low-mid front-mid vowel which is different to its NZE counterpart.

Figure (14): Representing the vowel space of Speaker 6.

As shown in Figure 15 which represents the vowel plots of Speaker 7, this vowel space seems to be more similar to a NZE vowel space than a Jordanian Arabic one. As mentioned in Table 1, Speaker 7, whose age was 15 years old when he was interviewed, came to NZ when he was one year old. The FLEECE vowel, which is high and front is clearly similar to both the Jordanian Arabic and NZE FLEECE vowels. The GOOSE vowel is identically produced to the NZE GOOSE vowel. The KIT vowel is very close to the centre which is one of the salient features of the NZE and Jordanian Arabic vowel systems. However, it overlaps with the FOOT vowel. Though the NZE FOOT vowel could overlap with the GOOSE or NURSE vowel, it is normally more to the front (Warren, 2017). This movement could lead to a potential overlap with the KIT vowel. The DRESS vowel is central which is not typical of the NZE vowel. The commA vowel is central and is clearly overlapping with the START vowel. The THOUGHT vowel (central back), shown in Figure 15, is pronounced as the same as the

NZE THOUGHT vowel. The FORCE vowel is very close to the THOUGHT vowel which is still similar to its NZE counterpart. The NURSE vowel is also close to the commA vowel but a bit lower. Warren (2017) indicates that in NZE there is a great distance between the NURSE vowel and the KIT vowel which is prominently visible in the production of this speaker. The LOT vowel is produced as a central back-mid vowel in the trapezium. The TRAP vowel is low-mid front-mid which is similar to NZE TRAP vowel. BATH (low back-mid) and STRUT (low-mid back-mid) are similar to their NZE counterparts. However, the BATH vowel (which is closer to its Jordanian Arabic counterpart) is not overlapping with the START vowel as it normally would be in NZE. The START vowel is, however, demonstrating an overlap with the commA vowel. Thus, although there are several similarities regarding the Jordanian Arabic vowel system in Speaker 7's vowel space, it appears this speaker has been influenced by New Zealand English to the point where his vowels carry only small traces of his heritage language, Jordanian Arabic.

Figure (15): Representing the vowel space of Speaker 7.
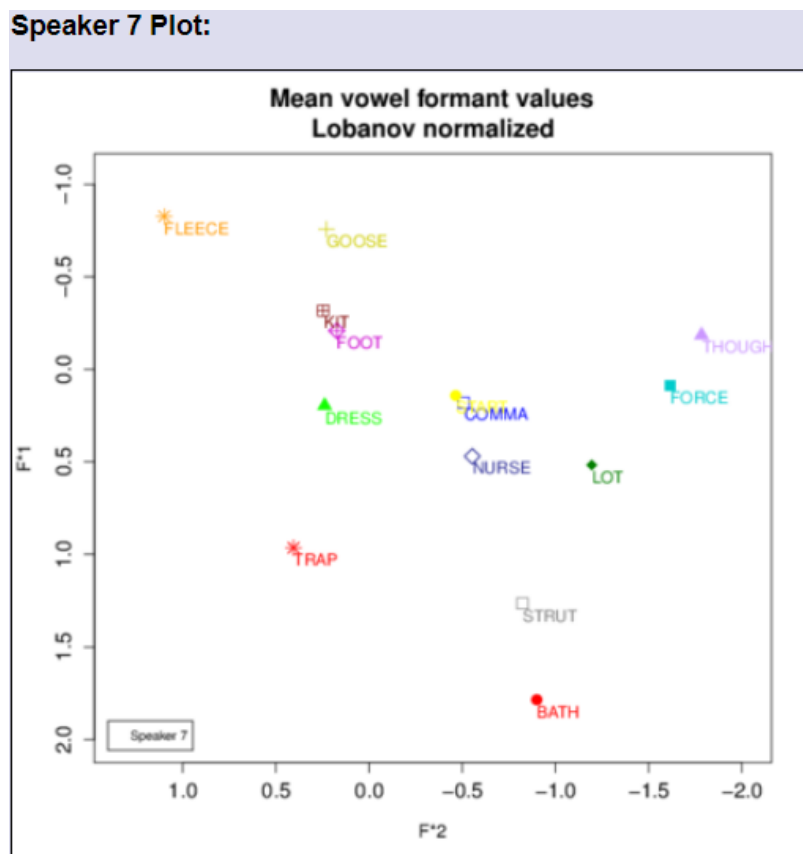
The vowel space shown in Figure 16 (which represents the vowel plots of the Speaker 8 whose age is 15 years old) reflects a strong influence of NZE. This speaker was the only participant born in New Zealand and the contrast is clear. The FLEECE vowel is articulated as a high front vowel which is identical to the NZE and Jordanian Arabic FLEECE vowel. The GOOSE vowel which is high front-mid is identical to the expected NZE counterpart. There is an overlap between the KIT, DRESS, and FOOT vowels where they are in the centre of the trapezium. The overlap between the KIT vowel and the FOOT vowel could be attributed to the FOOT vowel shifting toward the KIT vowel as predicted in Warren (2017). However, the NURSE vowel is produced in the low-mid back-mid position in the trapezium which is dissimilar to the NZE variant. There is another clear overlap between DRESS and KIT which is not a typical feature of NZE speakers. Warren (2017) hypothesised a raising of DRESS toward FLEECE, rather than toward the KIT vowel as in this speaker's tendency. However, Warren did not include the production of NZE speakers who were aged under 18, and it could be in the NZ Youth that these changes are occurring. The commA vowel is very central in the trapezium which reflects its NZE counterpart. There is an overlap between FORCE and LOT which are central back-mid in the vowel space, seen in Figure 16 which is not similar to the NZE. An overlap between THOUGHT and FORCE or between FOOT and FORCE could be predicted, as discussed by Bauer, Warren et al. (2007) and Warren (2017) but it would not be typical to see an overlap occurring between LOT and FORCE. The TRAP vowel, as shown in Figure 16, is almost central, which correlates with Warren's findings (2017). BATH (low-mid central) and START (low back-mid) are produced differently which differs from prototypical NZE. The STRUT is a bit lower and backer than BATH.

Figure (16): Representing the vowel space of Speaker 8.
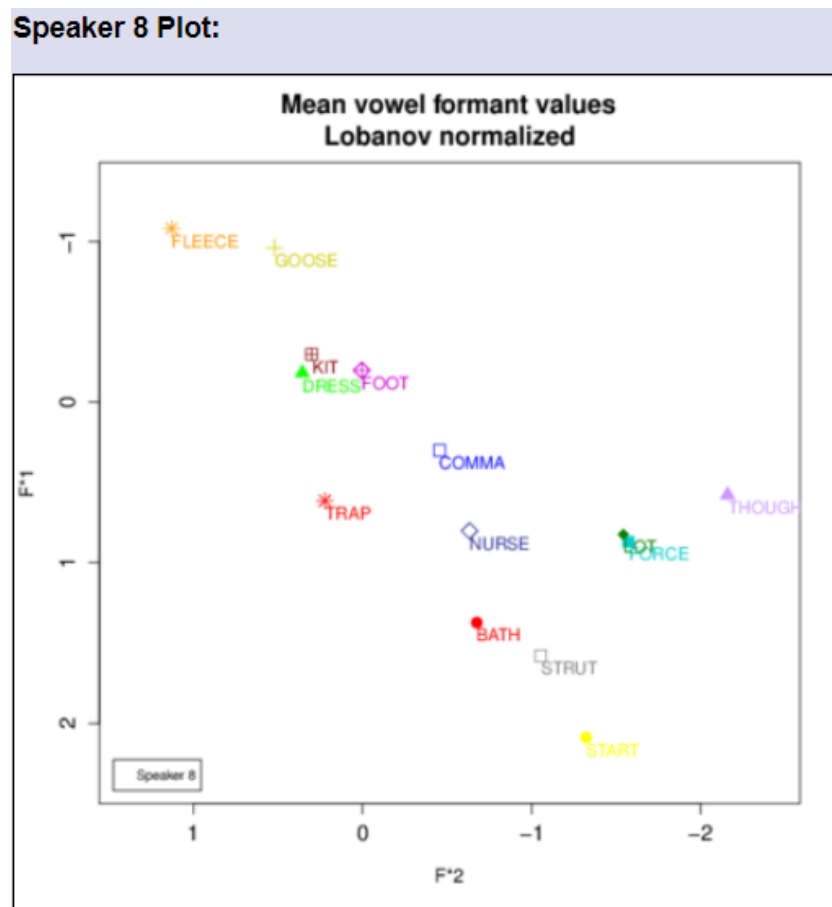
Finally, the vowel plot as seen in Figure 17 represents the vowel space of Speaker 9. Speaker 9 was two years old when he arrived NZ. At the time of conducting the interview with him, he was 23 years old. As with the previous eight speakers, this FLEECE vowel is produced as a high front vowel, similar to the NZE and Jordanian Arabic FLEECE vowels. The GOOSE vowel (high central) is identically articulated as it would be in NZE. There is an overlap between the DRESS and KIT vowels as they are both centrally located. This contradicts the expected overlap of DRESS and FLEECE, as is occurring in NZE (Warren, 2017). The commA and NURSE vowels are partially overlapping in the vowel space where they are a bit lower and backer in comparison to DRESS and KIT. Such an overlap perhaps indicates rhoticity, which can occur in NZE when NURSE is articulated slightly higher in the mouth than commA, (Bauer, Warren, Bardsley, Kennedy , & Major, 2007). The THOUGHT vowel is central back which is identical to its NZE counterpart. The FORCE vowel is very close to the

43

THOUGHT vowel which maps squarely onto protypical NZE pronunciation. The LOT vowel is central back-mid which is also similar to the NZE LOT vowel. The TRAP and FOOT vowels are overlapped which is not a typical feature of the NZE vowel system. However, TRAP raising has been documented by researchers such as Warren (2017). The BATH and START vowels behave in the predicted NZE manner. The STRUT vowel is very far from the BATH and START vowels, which are both dissimilar to the NZE START vowel. In Warren's (2017) study, he suggested that STRUT could occur higher than BATH/START, and given this does not occur in Figure 17, could suggest this speaker's vowels to not map to these prototypical New Zealand clearly.

Figure (17): Representing the vowel space of Speaker 9.
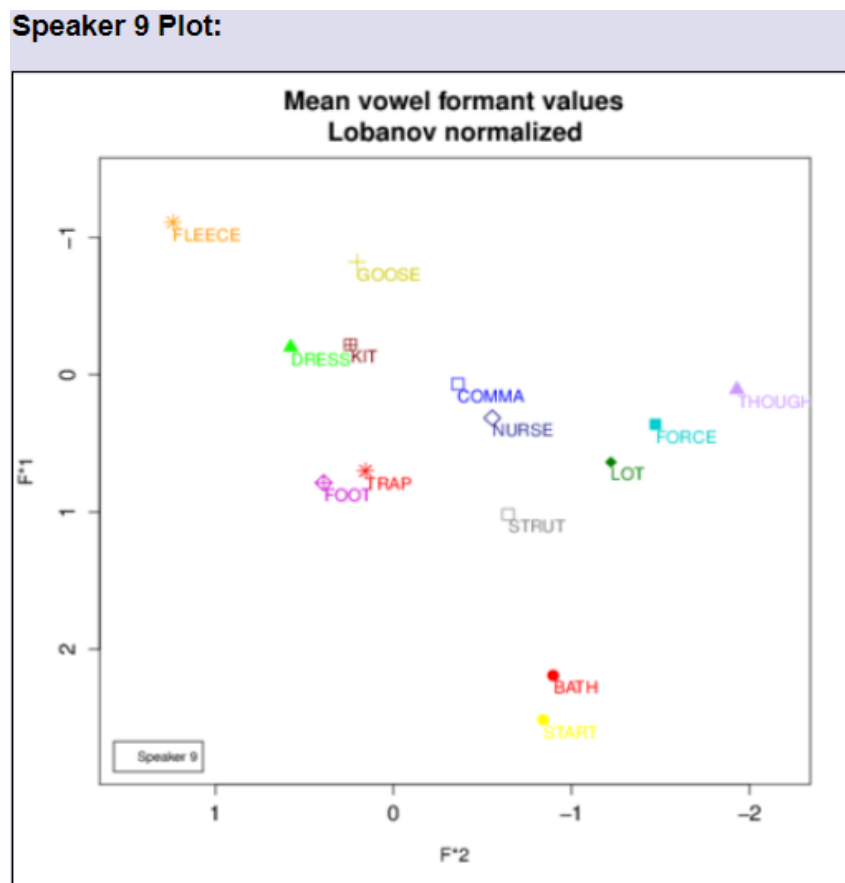
After careful observation of each individual's vowel space, I next performed statistical analysis on the data to explore the extent of age of arrival of immigrants on their English

pronunciation. I examined the DRESS, TRAP, and KIT vowels because they are useful in indicating a speaker of NZE, according to (Warren, 2017). The TRAP vowel is higher in the vowel space for New Zealanders than for other speakers of English (Warren, 2017). The DRESS vowel appears to be gradually moving up to overlap with the FLEECE vowel while the KIT vowel has centralised to the point where it can sometimes be interchanged with the commA vowel (Bauer, Warren, Bardsley, Kennedy , & Major, 2007; Warren, 2017). I particularly examined F2 of these vowels. The results of the models regarding F2 of the TRAP and KIT vowels did not show significant differences between groups. Thus, I excluded them in the statistical analysis while F2 of the DRESS vowel which showed a significant difference between groups is analysed below.

4.1.2. The DRESS vowel

In the Jordanian Arabic vowel system, there are eight distinct vowels as mentioned in section 2.1.1, of which DRESS is not one of them (Al-Tamimi, 2007). One aim of the current study is to explore the extent to which New Zealand English can affect the vowel systems of the Jordanian speakers of English living in Christchurch. The focus of this section is to see whether the age of arrival played a role in the realisation of the DRESS vowel across the nine speakers. To examine this, I fit a linear mixed effect regression model to the data, with DRESS as a dependent variable (F1 and F2 in separate models). The model identified significant differences between the three age groups regarding F2. The random effects were speaker (expecting different variants of the DRESS vowel by each speaker) and target orthography (that is, 'word', expecting different variants of the DRESS vowel for each word). As shown in Table 2, the coefficients of the linear regression model indicated that the "Older children" and "Younger children" groups are also significantly different from the "Fathers" group. Their p-values are 0.048082 and 0.000386 respectively. All of these values affirm that there is a significant difference between groups in terms of F2 of the DRESS vowel.

Table (2): Representing the output of the linear regression model which estimates the F2 (frontness) of the DRESS vowel in the production of all three ages groups.

Fixed effects:					
	Estimate Std.	Error	df	t value	Pr(>|t|)
(Intercept)	1495.522	42.052	10.696	35.564	1.88E-12
Older Children	130.274	57.045	9.061	2.284	0.048082
Younger Children	311.281	57.183	9.15	5.444	0.000386

Figure 18 provides understanding visual representation about how the DRESS vowel F2 varies across the three age groups. The F2 of the DRESS vowel produced by the "Younger children" generation is higher, representing a more advanced position (and also a slightly more raised position, given the configuration of the vowel space). This is similar to the NZE DRESS vowel produced by young NZE male speakers discussed by Warren (2017). Warren (2017) comment about DRESS raising referred to the production of young NZE speakers. The correlation with the F2 of the DRESS vowel produced by the "Younger children" generation who participated in the current study is evident. The F2 of the DRESS vowel is lower in the production of the "Older children" generation in comparison to the "Younger children" group, as seen in Figure 18. Furthermore, it is significantly different in the production of the "Fathers" group in comparison to the other generations. This means that the "Fathers" group produce the DRESS vowel (lower in comparison to NZE speakers) differently to the NZE equivalent in terms of F2.

Figure (18): Representing the output of the linear regression model which estimates the realisations of the DRESS vowel across the three groups.
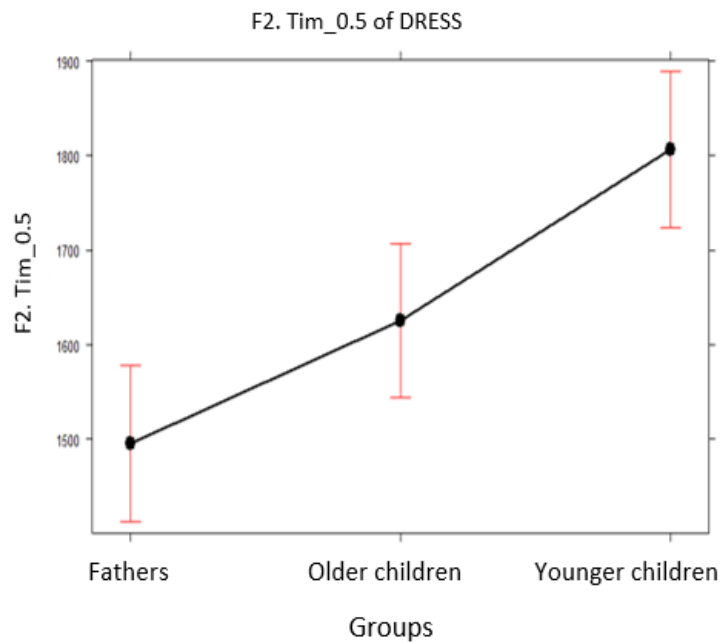
4.2. /t/

As mentioned above, /t/ has four possible realisations in NZE: tap, glottal stop, t-dropping, and canonical /t/. As can be seen in Figure 19, the most frequent variant in the production of the "Fathers" generation is the canonical /t/. In this dataset, canonical /t/ was realised by the oldest age group 48 percent of the time. T-dropping, however, was used by the fathers only 28% of the time. The glottal stop and tap variants in the production of the "Fathers" generation were rare compared to the production rate of the other generations, with a dramatic decrease to two percent for glottal stops and taps respectively. /t/s fluctuated across all variants for the "Older children" age group. For instance, tap and glottal stop were scarcely more frequent at 51% and 48% respectively in comparison to the t-dropping and canonical /t/s, 40% and 41% of the time respectively. There was a more noticeable split for the "Younger children" group's production. They produced canonical /t/ least of all, with only 11 percent of tokens being realised by the "Younger children" group. The "Younger children" group produced /t/ as a glottal stop most frequently with 50 percent of occurrences. This is clearly the favoured variant for the "Younger children" group followed by the

"Older children" group while it is rarely likely to be realised by a member of "Fathers" generation. There are also significant changes regarding tapping and t-dropping, with a 47/32 percent split.

Figure (19): Representing the percentage of the (-t) variants in the production of different generations

(-t) Variants Across Different Generations

	Glottal	Tap	T-dropping	[t]
■ Fathers	2%	2%	28%	48%
■ Older children	48%	51%	40%	41%
■ Younger children	50%	47%	32%	11%
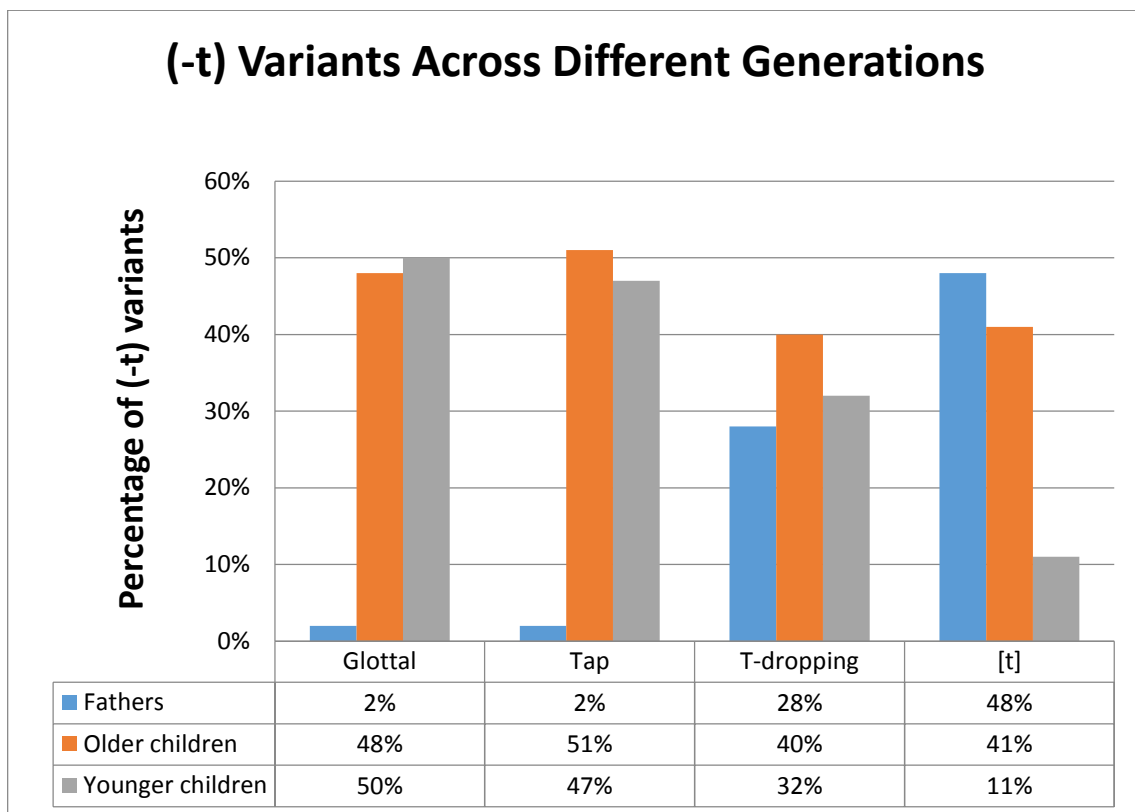
In terms of modelling the /t/ variants in the word-final position, a logistic regression model fitted the best to the data, in regard of demonstrating the word-final /t/ variant preferences of the three speaker groups.

The first mixed-effect logistic regression model treated /t/ in a binary fashion: present or absent. This meant that all variants of /t/ (glottal stop, tap, and t-dropping) were collapsed together to represent the absence of canonical /t/, whereas the others were coded with /t/ as 'present'. Through re-filtering the data, additional seven tokens were deleted because they were realised as a slip of the tongue. Overall, 405 canonical /t/s determined the 'presence' of /t/ and a total of 600

non-canonical variants, (437 glottal stops, 98 taps, and 65 t-dropping) represented the absence of canonical /t/. The independent variables were the groups (fathers, older children, and younger children) and the environments [V_#V]; [V_#C]; and [C_#V]. The dependant variable in this model was the absence of [t]s. Finally, the two random effects in the model were 'speaker' and 'target orthography', as explained in 4.1.2. The coefficients for the interaction between the groups and the environment, as shown in Table 3, illustrate that the intercept which is "Fathers" group is significant where its p-value is (4.66E-03). The slope representing the "Older children" group is also significant where its p-value is (4.76E-01). The "Younger children" is significant where its p-value is (2.16E-02). The environments [V_#V] showed a significant difference while [V_#C] did not show any significant differences where their p-values are (1.50E-01 and 0.11983) respectively. The interaction between "Older children" group with the [V_#C] environment and "Younger children" group with the [V_#C] environment is significantly different where their p-values, as shown in Table 3, are 0.00269 and 0.00326 respectively. This result indicates that when the environment is in the condition of [V_#C], it occurs alongside the glottal stop among both "Older children" and "Younger children" groups. The interaction between the "Younger children" group and the [V_#V] environment is scarcely significant where the p-value is 0.00464 but the interaction between the "Older children" group and the [V_#V] environment is almost significant, showing some differences where the p-value is (0.0578). Another interesting result is that the "Younger children" and "Older children" speakers also produce /t/ differently when it is realised in the [V_#V] environment where the tap variant instead of /t/ is realised. Such a realisation highly likely supports the hypothesis that the "Younger children" and "Older children" informants produce /t/ as a tap when it is intervocalic.

Table (3): Representing the output of the interaction model which estimates the realisations of the canonical /t/ presence or absence.

Fixed effects:				
	Estimate Std.	Error	z value	Pr(>|z|)
Intercept	3.1484	1.1127	2.83	4.66E-03
Older Children	-0.6678	0.9359	-0.714	4.76E-01
Younger Children	-2.4579	1.0702	-2.297	2.16E-02
V_#C	1.4841	1.0303	1.44	1.50E-01
V_#V	1.7491	1.1245	1.556	0.11983
Older Children * V_#C	-2.7028	0.9008	-3.001	0.00269
Younger Children * V_#C	-3.1884	1.0839	-2.942	0.00326
Older Children * V_#V	-1.9164	1.0101	-1.897	0.0578
Younger Children * V_#V	-3.4923	1.2337	-2.831	0.00464

Figure 20 illustrates the interaction between the environments and the groups for the /t/ variants. It is clear that the likelihood of canonical /t/ being produced sharply drops over the three generations within the [V_#V] and [V_#C] environments. More clearly, it is less likely to be realised in the production of the "Younger children" group within the [V_#V] and [V_#C] environments while it is a prominent feature in the production of the "Fathers" group. The [C_#V] environment does not display any significant variation between the three generations.

Figure (20): Representing the interaction between the environments and the groups regarding the /t/ variants.
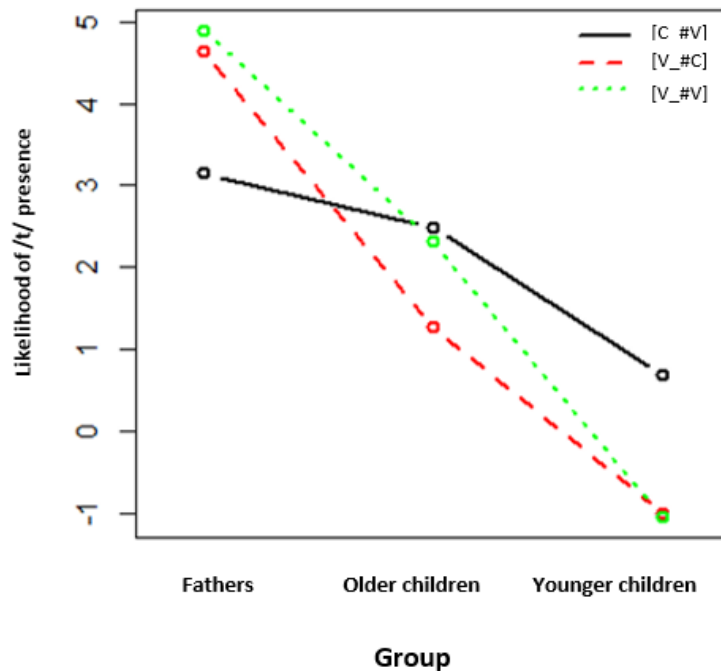
Regarding the glottal stop, Table 4 shows that the relationship between the groups and the environments with the assumption of a linear model. The logistic regression model which was fitted to analyse the use of the glottal stop in the production of the three groups demonstrated no interaction between the independent variables, discussed in 5.2. The dependent variable in the second model was the binary variable referring to the presence or absence of the glottal stop. Similar to the first model, all of the taps, canonical /t/s, and t-dropping variants were collapsed together to represent the absence of glottal stop, while the glottal stop was indicative of the presence of a glottal stop. The independent variables were identical to above to maintain continuity; the age groups and the linguistic environment, with speaker and orthography as random effects. As shown in Table 4, the model predicted a significant relationship between the groups and the environments. More precisely, the coefficients show that the intercept ("Fathers" group) was significant, with a p-value of (4.89E-15). The p-values of slopes (Older children and Younger children) groups were also significant with p-values of 2.47E-05 and 8.50E-10 respectively. The environments

51

[V_#V] and [V_#C] were also significant with p-values of 7.43E-07 and 0.00388 respectively. There was no significant interaction between groups and environments.

Table (4): Representing the output of the logistic regression model estimating the realisation of the glottal stop.

Fixed effects:				
	Estimate Std.	Error	z value	Pr(>|z|)
Intercept	10.6402	1.359	7.83	4.89E-15
Older Children	-4.3684	1.0358	-4.218	2.47E-05
Younger Children	-6.642	1.0826	-6.135	8.50E-10
V_#C	-4.5411	0.9175	-4.95	7.43E-07
V_#V	-2.6502	0.9178	-2.888	0.00388

Figure 21 shows the probability of glottal stop use in the production of the three generations (Fathers, Older children, and Younger Children). The glottal stop in the production of the "Younger children" group is a very apparent feature while it is less present in the production of the "Father" group. Regarding the production of the "Older children" group, it occurs more frequently than for the "Fathers" group, but less frequently than the younger children.

Figure (21): Representing the output of the logistic regression model which estimates the likelihood a glottal stop realisation across the three groups.
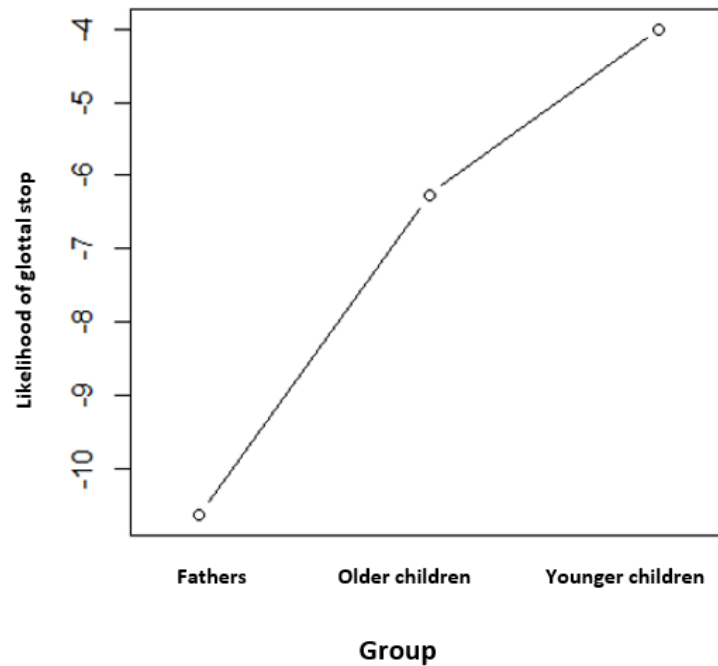
In an account of the variation of the glottal stop within the environments, Figure 22 demonstrates that the [V_#C] environment is the most common environment where the glottal stop is likely to occur. The second environment where the glottal stop is likely to occur is the [V_#V] environment. It is clear that the [C_#V] environment is not a context where the glottal stop is often realised. This more likely attributes that the glottal stop is a bit vowel-like. As a result, it is hard to articulate vowels side by side. Although this result converges with the hypothesis that the glottal stop is more likely to be realised among the "Younger children" while it is less in the production of the "Older children", it does not support the expectation regarding the environment (see section 1.2.1).

Figure (22): Representing the output of the logistic regression model which estimates the realisations of the glottal stop across different environments.
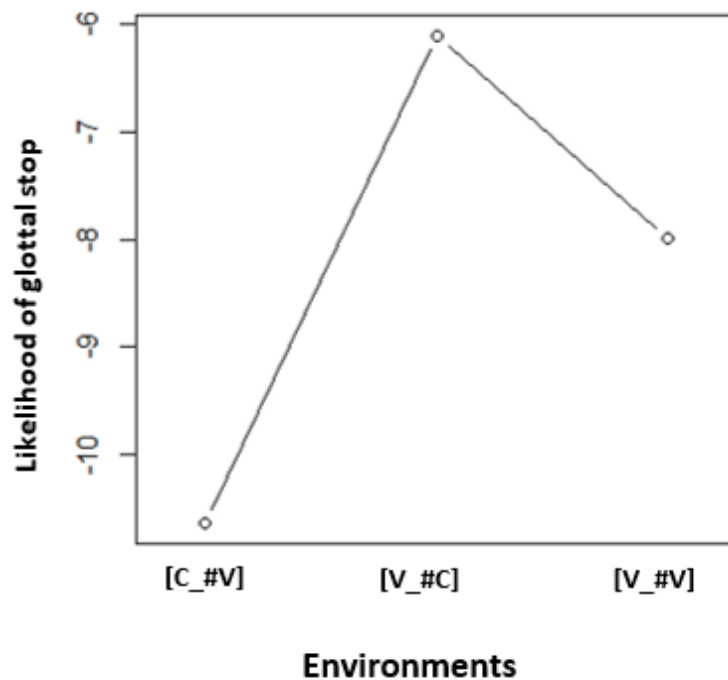
In terms of the tap variant, Table 5 presents a logistic regression model in the same display as the previous two variants. I used an Anova to test which model is significantly more appropriate in the analysis of the tap variant. The Anova test affirmed that the logistic regression model estimating the tap variant was fitted where its Akaike's Information Criterion (AIC) was a bit lower (312.43) in comparison to its AIC of the logistic mixed model (317.19). Sugiura (1978) pointed out that the less the values of AIC, the more the model is appropriate. The dependent variable of the model was a binary variable coding the presence or absence of the tap variant. The independent variables were identical to the previous two models. The dependant variable was the absence of the tap variant. The model shows that there was a significant relationship between the groups and the environments and the presence or absence of the tap variants, although there was no significant interaction between groups and environments. The coefficients show that the intercept ("Father" group) was significant with a p-value of 4.89E-15. The p-values of the slopes of the younger generations were

also significant with p-values of 2.47E-05 and 8.50E-10 respectively. Further, the environments

[V_#V] and [V_#C] also came out significant with their p-values of 7.43E-07 and 0.00388 respectively.

Table (5): representing the output of the logistic regression model which estimated the presence of absence of the tap variant

Fixed effects:				
	Estimate Std.	**Error**	**z value**	**Pr(>|z|)**
Intercept	10.6402	1.359	7.83	4.89E-15
Older Children	-4.3684	1.0358	-4.218	2.47E-05
Younger Children	-6.642	1.0826	-6.135	8.50E-10
V_#C	-4.5411	0.9175	-4.95	7.43E-07
V_#V	-2.6502	0.9178	-2.888	0.00388

Figure 23 shows in the likelihood of producing a tapped /t/ across the three groups (Fathers, Older children, and Younger children). It is noticeable that there is an increasing use in the tap variant through the productions of the "Younger children" and "Older children" generations. That means that it is a widespread feature in their production while it is almost absent in the production of the "Fathers" group. This is similar to the glottal stop variant. This output is another evidence supporting the hypothesis that tap is a favourable variant of /t/ in the production of the "Younger children" and "Older children" while it is not in the "Fathers'" production (see section 1.2.2).

Figure (23): Representing the output of the logistic regression model which estimated the presence or absence of the tap variant across generations
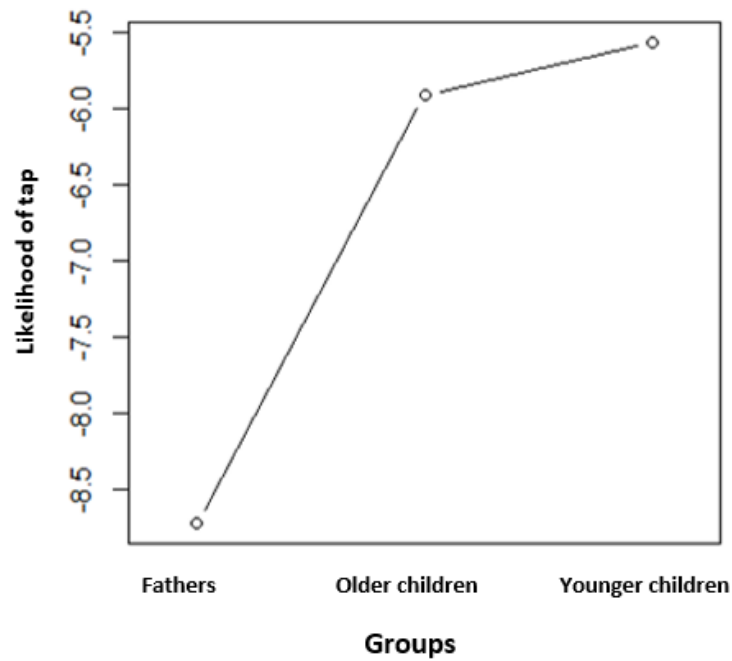

Figure 24 provides a depiction of the distribution of environments where the tap variant occurred in this dataset. As shown in Figure 24, the most favourable environment for the tap variant to occur is the [V_#V] environment. The tap variant is almost absent in the [C_#V] and [V_#C] environments.

Figure (24): Representing the output of the logistic regression model which estimates probability of a tap variant occurring in different environments.
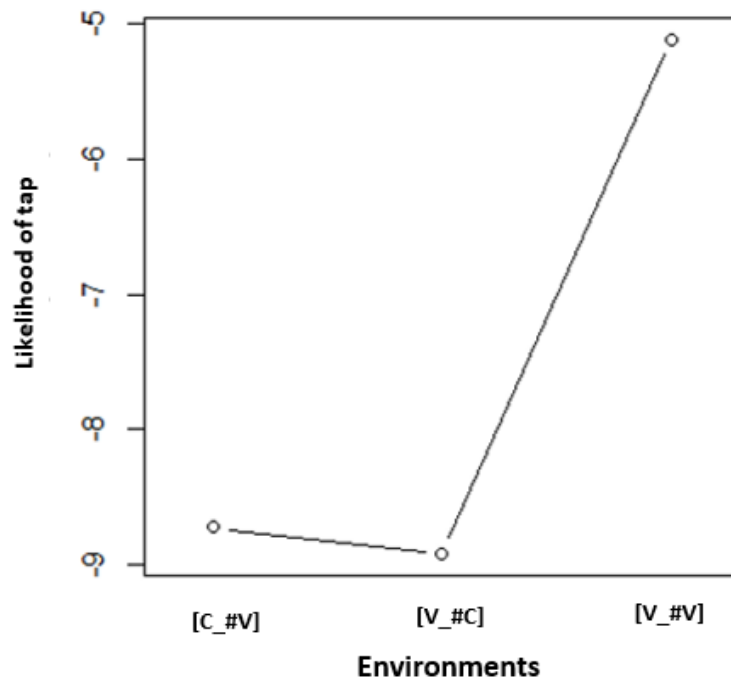
Finally, Table 6 shows the output of the t-dropping variant in the production of the three generations (Fathers, Older children, and Younger children) across the same three environments by using the logistic regression model. The results of the Anova test indicate that the more fitting model to such a context is the logistic regression model where its AIC value was lower. In this model, the dependent variable was the presence or absence of the t-dropping variant while the independent variables were the groups and the environments controlling for the two random effects which are well-discussed above. For this variant, the whole groups came out significant whereas the p-values of the "Fathers", "Older children", and "Younger children" groups were 3.08E-04, 2.74E-01 and 6.67E-01 respectively. The figures in Table 6 also reflect that the [V_#V] environment was not at all significant (p-value 0.957015). There is a significant difference in the [V_#C] environment where its p-value is 6.48E-02.

Table (6): Representing the output of the logistic regression model which estimates the likelihood of the t-dropping variant occurring.

Fixed effects:				
	Estimate Std.	**Error**	**z value**	**Pr(>|z|)**
Intercept	-7.5029	2.0791	-3.609	3.08E-04
Older Children	-1.2621	1.154	-1.094	2.74E-01
Younger Children	-0.4998	1.1613	-0.43	6.67E-01
V_#C	-2.8477	1.5418	-1.847	6.48E-02
V_#V	-24.6834	457.9514	-0.054	0.957015

In Figure 25, there is a clear evidence that the t-dropping variant is a widespread feature in the production of the "Fathers" group's speech while it is not in the production of the "Older children" group. It means that this feature is frequently used by the "Fathers" group while it is produced less often in the "Older children" group. The chart also shows that the t-dropping variant in the production of the "Younger children" group is present but it is not significant.

Figure (25): Representing the output of the logistic regression model which estimates the realisations of the t-dropping variant through different groups.
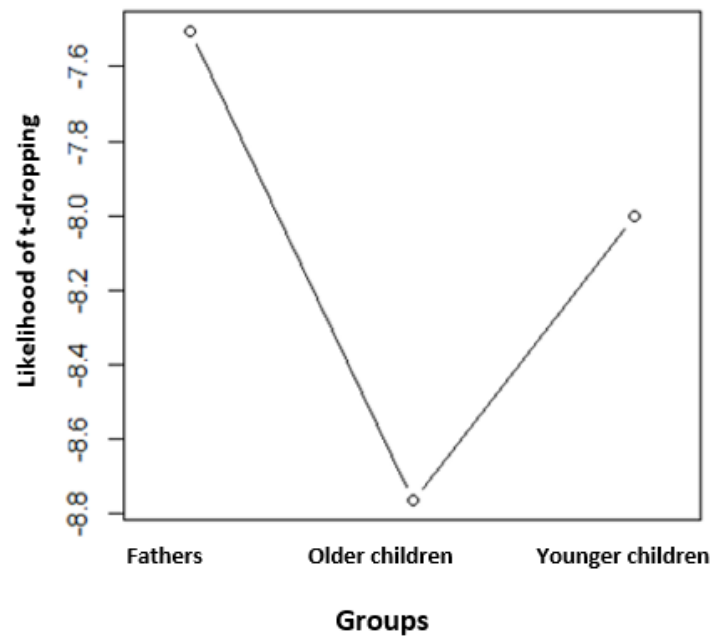

Figure 26 shows the most likelihood of the three environments of the t-dropping variant. The [C_#V] and [V_#C] environments, as shown in Figure 26, are the most favourable environments where t-dropping could occur. However, it is apparently absent to rarely occurring in the [V_#V] environment.

Figure (26): Representing the output of the logistic regression model which estimated the likelihood of the t-dropping variant across different environments.
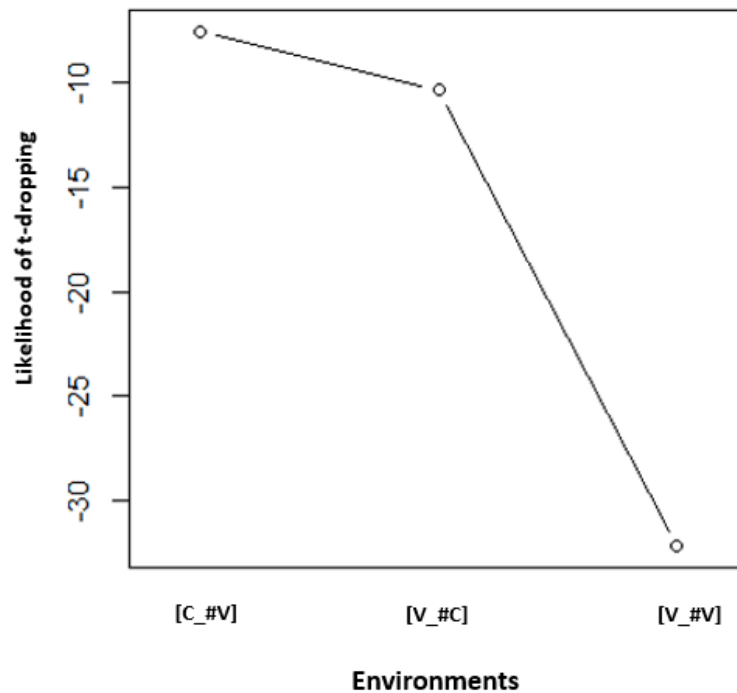
4.3. /r/

The model which was fitted to analyse the rhoticity was a logistic mixed model. Similar to /t/, the dependent variable in this model was a binary variant reflecting the presence or absence of /r/. Flaps, approximants, linking /r/, and trill variants were coded as /r/ being present, whereas a vowel or the non-realisation of /r/ where it exists in an orthographical context were coded as /r/ being absent. As pointed out above, intrusive /r/ will not be explored in the current study due to insufficient data. Figure 27 provides more detail about the realisations of /r/ in the production of each generation. It is clear that the rhoticity is a feature in the production of all three generations. The highest percentage reflecting the presence of /r/ is in the production of the "Older children" group by 77% while it is the lowest in the production of the "Younger children" group by 63%. Regarding the absence of /r/, the highest percentage is prominently in the production of the "Younger children" group while it is the lowest in the production of the "Older children" group by 37% and 23% respectively. The percentage of the absence of /r/ in the production of "Fathers" is

24%. The total number of present /r/ tokens submitted to the model shown in Table 7 was 891 with

336 tokens of the alternate (absent) variants.

Figure (27): Representing the percentage of the /r/ variants in the production of different

generations
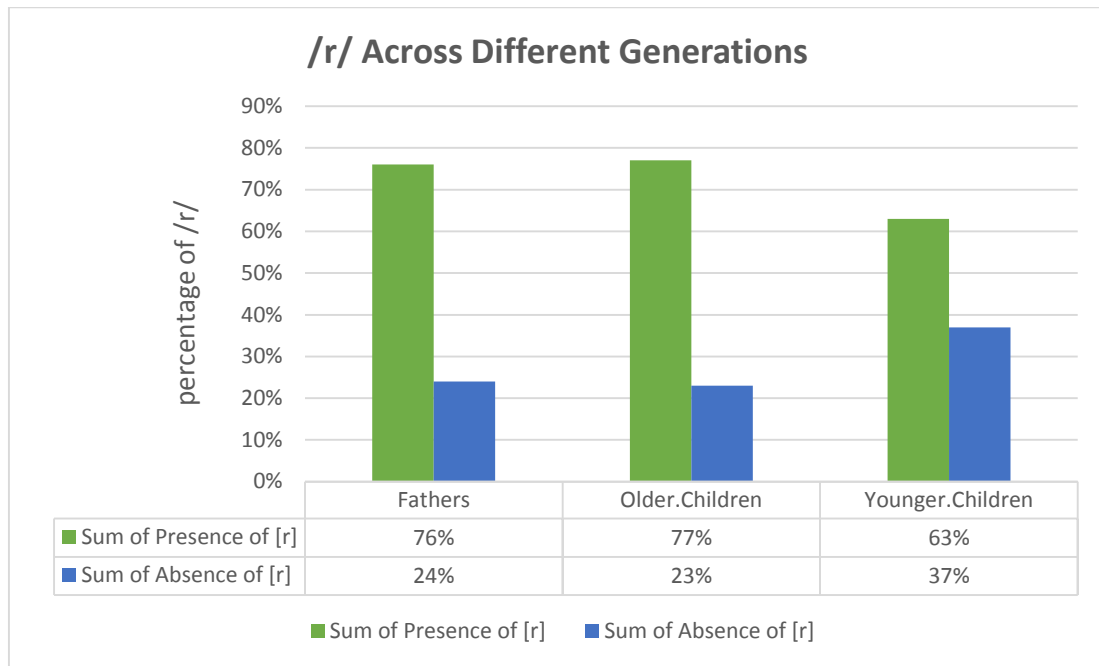
Table (7): Representing the total number of /r/ tokens submitted to the logistic mixed model

analysing the rhoticity.

Groups	Sum of Presence of /r/	Sum of Absence of /r/
Fathers	290	93
Older Children	374	109
Younger Children	227	134
Grand Total	**891**	**336**

Table 8 shows that there is a significant interaction between the group and the

environment. The intercept ("Father" group) is significant where the p-value is 3.05E-03. The slopes

("Older children" and "Younger children" groups), are significant with p-values of 4.42E-01 and

9.04E-04 respectively. It is also clear that the [V_#C] environment is significant where its p-value is

(5.43E-03). Regarding the interaction between the groups and the environments, the p-value of the

interaction between the "Younger children" group and [V_#V] environment is significant (p-value

0.00012). There is not a significant interaction between the "Older children" group and the

environment [V_#V].

Table (8): Representing the output of the interaction model which estimates the likelihood of the

presence or absence of /r/.

Fixed effects:				
	Estimate Std.	Error	z value	Pr(>|z|)
Intercept	1.4601	0.4928	2.963	3.05E-03
Older Children	-0.5148	0.6696	-0.769	4.42E-01
Younger Children	-2.2567	0.68	-3.319	9.04E-04
V_#V	1.5867	0.5706	2.781	5.43E-03
Older Children * V_#V	-0.358	0.6425	-0.557	0.57736
Younger Children * V_#V	2.6597	0.6916	3.846	0.00012

Figure 28 provides a visual cue regarding the values in Table 8. As seen in Figure 28, the

realisation of /r/ is seldom occurring in the production of the "Younger children" group within the

[V_#C] environment while it is a prominent feature in their [V_#V] environment (where one would

expect linking /r/ to occur). The "Fathers" group also show that the rhoticity occurs most in the

[V_#V] environment and less often in the [V_#C] environment. The "Older children" group did not

show any significant differences regarding the [V_#V] and [V_#C] environments. This result is in line

with the hypothesis that /r/ is more likely visible in the production of the "Younger children's" when it is intervocalic such as *'caring'* in comparison to the other groups ("Fathers" and "Older children") as a way to fulfil the requirement of linking /r/.

Figure (28): Representing the interaction between the environments and the three age groups regarding the /r/ presence.
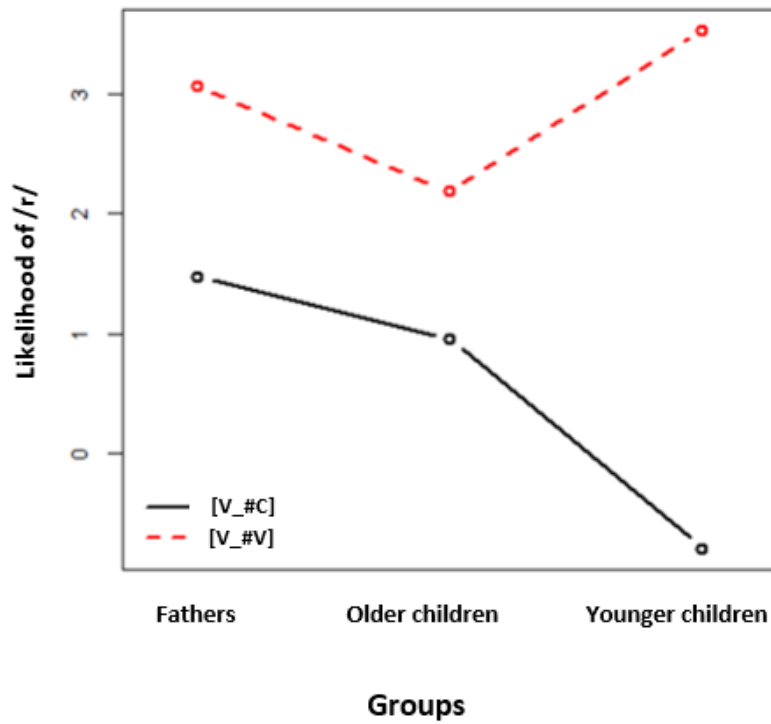
Chapter Five

Discussion

As pointed out above, different scholars have acoustically and auditorily examined distinct features of NZE (such as variation of /t/, /r/ and vowels) produced by native speakers of NZE. However, investigating such features in the production of non-native speakers of NZE has not yet been well explored. Nycz (2015), Tagliamonte & Molfenter (2007), and Walker (2014) argued that age of arrival was an influential factor for acquiring different phonological markers of a language variety.

Consequently, the current research sheds light on the importance of an immigrants' age of arrival on their ability to successfully acquire linguistic features of the host country's dialect. I selected three age groups to examine (Fathers, Older children, and Younger children) and investigated in depth their realisation of vowels, /t/, and /r/ when speaking English. The majority of the speakers had spent similar amounts of time in Christchurch, New Zealand. They were of the same gender, regional and ethnic background, namely middle-eastern men from Jordan. This research contributes to the understanding of immigrant acquisition of 'foreign' phonological features and how this acquisition is influenced by age of arrival.

5.1.   Vowels

The vowels produced by the informants, as explored in section 4.1.1, varied according to the three generations. It was clear that NZE had a clear and strong influence on the two younger groups (Older children and Younger children), but scarcely influenced the "Fathers" group. Such a reflection could converge with the importance of the age of arrival as a factor influencing language/dialect acquisition (Nycz, 2015; Walker, 2014). In order to support such a claim, the most considerable movements of the vowel plots shown above will be discussed in depth. Then, I will discuss how the DRESS vowel could provide more evidence that acquiring a second language/dialect as an adult is more difficult.

The KIT vowel produced by the "Older children" and "Younger children" groups is almost centralised in their vowel space in line with one of the most unique NZE vocalic features (see Bauer,

et al., 2007; Warren, 2017). However, such a feature is also visible in the Jordanian Arabic vowel system (Al-Tamimi, 2007). Raising the TRAP vowel (in comparison to historical NZE dialects) as discussed by (Warren, 2017) is prominently visible in the production of the "Older children" and "Younger children' groups. Primarily, such a movement is absent in the production of the Jordanian Arabic produced in Jordan (see for example Al-Tamimi, 2007 and Kalaldeh, 2016). Regarding the NZE BATH vowel, it is still low central but it appears to be raising, as Warren (2017) argues. It occurs close to the NZE TRAP vowel which is evident in the "Older children" and "Younger children" groups' production. Warren (2017) discusses that overlapping between the STRUT and START vowels is a remaining question in his research. To address such a question, I focus on speakers 4, 5, 6 & 9 because these speakers are very similar in terms of the age. They, as mentioned in section 4.1.1, produced the BATH vowel as close to the START vowel in the vowel trapezium which is a considerable feature of NZE. The distance between the BATH and STRUT vowels in the production of the speakers (4, 5, 6, and 9) did not demonstrate an overlap as would be expected in typical NZE. This result would provide evidence that there is no an overlap between STRUT and START auditorily. Speaker 6 (who came to NZ when he was 15 years old) produced BATH and START differently but they were still close to each other in his production (low back-mid). BATH and START produced by Speakers 7 and 8 (who are the youngest) were realised as separate vowels. Such a result could suggest that there is another trend in the NZE vowel system generated by NZE speakers who are 15 years old or younger regarding BATH and START. This would have to be tested in further study. The FORCE and THOUGHT vowels in the production of the whole "Younger children" group and Speaker 5 (one of the "Older children" group) are produced similarly (central back). Such a production aligns with NZE where these vowels overlap (Bauer, Warren, Bardsley, Kennedy , & Major, 2007). Kaladeh (2016) argues that the THOUGHT vowel which is produced by the Jordanian Arabic speakers is realised differently to its English equivalent. Such a realisation is very prominent in the production of Speaker 1. The THOUGHT vowel in the production of Speaker 1 is low central which is not the case with other participants' production. Warren (2017)'s study claims that the FOOT vowel is fronting

toward the GOOSE vowel. In this study, the F1 values of the GOOSE and FOOT vowels were similar to their NZE counterparts whereas they were different regarding F2 values. Speaker 2 and Speaker 5's vowel spaces display an overlap between FOOT and GOOSE which aligns with Warren (2017)'s results. The GOOSE vowel for most of the speakers in this study was realised similar to the NZE realisation. Al-Tamimi (2007) and Kaladeh (2016) mentioned that the Jordanian GOOSE vowel was more likely to be high back. However, it is saliently produced as a high central vowel by both the "Older children" and "Younger children" groups, identical to the NZE GOOSE vowel. Regarding the "Fathers" group, two of them (Speaker 2 and Speaker 3) produce it similarly to the NZE GOOSE vowel while it is differently articulated by Speaker 1 in terms of F2 but similar in an account of its NZE F1 value. The LOT vowel (which is absent in the Jordanian Arabic vowel system) is produced as a central back-mid vowel by most of the participants. Gnevsheva (2015) found that the LOT vowel was raising and fronting toward the centre of the vowel space for NZE speakers, which is identical to the placement of this vowel by all speakers in this study with the exception of Speaker 1, where it was realised as a low-mid back vowel. Kaladeh (2016) mentions that the LOT vowel is realised as a low back vowel in Jordanian English. The commA vowel is produced as a central vowel in the vowel space by both the "Older children" and "Younger children" groups while it is a bit lower for Speakers 1 and 3. Speaker 2 pronounced the commA vowel identically to the "Older children" and "Younger children" groups' production. This could have occurred due to his highly frequent contact with a NZE speaker (his wife). What's more, this speaker reported that his marriage from a NZE partner played a significant role in improving his English. Such a claim is clearly visible especially in the commA, LOT, START, and STRUT vowels where his speech aligns more with NZE pronunciations than typical Jordanian productions. Regarding the NURSE vowel, although it is absent in the Jordanian Arabic vowel system (Al-Tamimi, 2007; Kalaldeh, 2016), it is clearly prominent in the production of the Jordanian speakers of English living in Christchurch. Warren (2017) states that the distinction between the KIT vowel and the NURSE vowel is increasingly prominent in the production of the young speakers of NZE. This claim was supported in the production of the "Younger children" group

where the KIT vowel appeared distinct from the NURSE vowel. In addition, Gnevsheva (2015) illustrated that the NZE NURSE vowel was highly likely to be realised as a commA vowel (central) which was noticeable in this study, especially within the "Younger children" group.

The DRESS vowel is one of the most salient features of NZE. Warren (2017) points out that there is a noticeable movement toward the FLEECE vowel in the NZE native speakers regarding the DRESS vowel mainly in the production of the young speakers of NZE. The current study supports his point, as the DRESS vowel's high position, near FLEECE vowel is very apparent in the production of the "Younger children" generation. The "Younger children" generation produced F2 of the DRESS vowel similarly to the young speakers of NZE in Warren's (2017) study. F2 of the DRESS vowel in the production of the "Older children" was still high and close to its NZE equivalent in the production of the middle-aged males of NZE, also in line with Warren (2017). In regard to the F2 of the DRESS vowel produced by the "Fathers" group, it was not in any way similar to the NZE production. This reflects the difficult of acquisition by older speakers in terms of a new language/dialect. As I mentioned above, there is no study published yet examining the production of young (<18 years old) NZE speakers. All of the studies conducted examining the NZE vowel system examined the speech of adult (>= 18 years old) NZE speakers (Bauer, Warren, Bardsley, Kennedy , & Major, 2007; Warren, 2017). I believe that conducting a study exploring the vowel space produced by child and adolescent speakers of NZE may provide other evidence of movements happening within the NZ vowel system. Finally, the FLEECE vowel, was identical across all speakers, produced on the top left corner of their vowel space. Such a result is hardly surprising, as both the Jordanian Arabic and NZE FLEECE vowels are in this position (Al-Tamimi, 2007; Bauer, Warren, Bardsley, Kennedy , & Major, 2007).

In conclusion, the age of arrival was a significant factor affecting speakers' production of vowels. As I discussed above, there are many vowels realised closer in line to NZE vowels than Jordanian English. Such a finding disagrees with the hypothesis mentioned in section in 1.2.1 that the "Fathers" group will be identified based on their heritage language vowel system. The hypothesis was expected based on Al-Tamimi (2007) and Wagner's (2012) claims. Al-Tamimi (2007),

argued that the vowel system plays a main role in identifying speakers' heritage language. Wagner (2012) indicates that acquiring the phonological features through the adult age is more difficult than for younger speakers. However, the results of the current study show that different L2 vowels could be acquired in an adult age as shown in the production of Speaker 2 and Speaker 3 (Figure 10 and Figure 11 respectively). In other words, acquiring the vocalic attributes may not require particular phonological environments to be affected, in comparison to consonants. For instance, the tap variant instead of /t/ in NZE word-middle position should be surrounded by vowels to be realised (Fiasson, 2016). Moreover, exposing to the target language as a way of acquiring it is another factor which might affect the production of speakers.

5.2.   /t/

Regarding /t/, I hypothesised that the glottal stop and tap would be visible in the production of the "Younger children" and "Older children" generations whilst being almost absent in the production of the "Fathers" group. This hypothesis is assumed to follow the previous literature (i.e. arriving at the young age plays a main role in acquiring the production of speakers (Nycz, 2015)). I also predicted these variants would be realised in particular phonological environments [V_#C] and [V_#V] respectively according to claims of Docherty et al. (2006) and Holmes (1995; 1994) regarding the glottal stop and tap environments in NZE. In terms of canonical /t/ I hypothesised it would be more visible in the production of the "Fathers" group rather than the other groups based on (Kalaldeh, 2016)'s claim. Kalaldeh (2016) mentions that a voiceless alveolar stop is only a main variant of /t/ in the Jordanian English.

/t/ was realised four different ways by the speakers in this study: glottal stop, tap, canonical /t/, and t-dropping. The glottal stop, is a typical NZE feature, and also occurred in the production of the Jordanian speakers of English in Christchurch. Bayard (1990) examined /t/ in the production of the NZE native speakers using a wordlist and reading passage in extracting the data. He observed an increase of /t/ produced as a glottal stop. This production of a glottal stop is evident amongst the "Older children" and "Younger children" groups. The glottal stop was clearly a frequent variant in

the production of the younger informants where 50 percent of the total glottal stops were produced by the "Younger children" group and 48% of the total number of the glottal stops were produced by "Older children" group, accounting for 98% of the total production. Out of all the occurrences of 'tap', once again 98% of the occurrences were realised by the two younger groups (51 % by the youngest group and 47% by the middle ("Older children") group). Both of these features (glottal stop and tap) are the common features realised by NZE speakers. Fiasson (2016, p. 13) claims that tap is one of the most frequent variant realised in NZE nowadays. It has been, as he claims, increasing over time intervocalically. Because the current study concerns about the /t/ in the word-final position, it was not possible to test this claim. Nevertheless, it was clearly a prominent feature in the production of the "Older children" and "Younger children" groups in word-final position. As shown in Figure 23, tap was almost absent in the production of the "Father" groups. Such a result could suggest that tap was one of the main features which is not simple to be acquired in an adulthood age, and could suggest that the age of arrival in the current study had an influential role in affecting the production of the informants. Regarding /t/, Kalaldeh (2016) and Huthaily (2003) both stated that /t/ in the Arabic language is a voiceless alveolar stop. This production, as shown in Figure 19, was evident in the production of the "Fathers" and "Older children" groups, potentially reflecting one of their main heritage phonological features. In Figure 20, the logistic mixed model fitted showed that the likelihood of /t/ interacted with age, particularly for "Fathers" and "Older children" groups. It was the lowest in the production of the "Younger children" compared to the other groups. Such a drop in canonical /t/ realisations among the Jordanian speakers of English living in Christchurch mirrors the scenario occurring in NZE. Finally, the t-dropping, as shown in Figure 25, was prominently visible among the "Fathers" group followed by the "Younger children" group. It was surprisingly almost absent in the production of the "Older children" groups.

In terms of the phonological environments, as in Figure 22, the glottal stop was more likely to occur in the [V_#V] and [V_#C] environments. Holmes (1995; 1994) pointed out that the glottal stop was more likely to occur pre-vocalically. Docherty et al. (2006) also examined the preceding

environment and claimed that pre-vocalic environments were the most favourable for glottal stop productions. Regarding the following environment, Holmes (1995) states that the glottal stop is occurred when it is followed with consonants or a pause. The results of the current study support these claims. This research found that the most favourable preceding sound was vocalic while it is consonantal in the following sound. In other words, the logistic regression model confirms that such an environment is the most common one to realise the glottal stop followed by [V_#V] environment where its p-value is 0.00388. Both of these results still support the claim issued by (Docherty, Hay, & Walker, 2006; Holmes, 1995; 1994) in an account of the preceding and following environments. Fiasson (2016) studied how /t/ was realised by NZE speakers and concluded that the glottal stop was not significantly visible in the word-middle position, so perhaps it occurs more often word-finally, as discovered in this study. Tap was another popular variant realised in the production among the "Older children" and "Younger children" generations. Hay et al. (2008, p. 38) revealed that the tap variant was often constrained with a particular environment which was between vowels within one word-boundary. The present study also supports that the [V_#V] environment is one where tap could occur but it also occurred across two word-boundaries. It seems that taps in NZE occur within the intervocalic environment, either intervocalically as demonstrated by Fiasson (2016) or across word boundaries as demonstrated in this thesis. As shown in Figure 24, the only significant environment where tap was realised was [V_#V]. In regard to canonical /t/, Figure 20 demonstrated that the "Fathers" group produced /t/ in all environments: [C_#V]; [V_#V]; and [V_#C]. The "Older children" group, as shown in Figure 20, were more likely to produce /t/ only in the [C_#V] and [V_#V] environments. The "Older children" group used either glottal stop or /t/in the same environments as the glottal stop [V_#C] and were less likely to use canonical /t/ where they realised /t/ as a tap (which is [V_#V]). Contrastingly, canonical /t/ among the "Younger children" generation was almost absent in the [V_#V] and [V_#C] environments. Instead these respondents produced tap and glottal stops. This indicates that the "Younger children" generation is performing more like NZE speakers than the other Jordanian speakers. Such an aspect evidently reflects the importance of the

age of arrival in acquiring not only the language but also highlights the variability across phonological constraints. The younger speakers arrive, the more likely they are to acquire the constraints of the host language. The t-dropping, as seen in Figure 26, was also constrained with a consonant either before or after it. This could suggest that canonical /t/ is less likely to be realised when it is surrounded by a consonant.

5.3.   /r/

The present study sheds light on how non-rhotic English features such as linking /r/ are acquired by speakers who have learnt a rhotic variety of English. Additionally, I discuss how age of arrival affected the rhoticity of the Jordanian speakers. I explored to what extent their adaptation was limited (not acquiring the linking /r/) or unlimited (acquiring linking /r/ and enabling to function it properly regarding its environmental constraints). Hay & Sudbury/ (2005) and Hay et al. (2008) pointed out that NZE is a non-rhotic accent (where /r/ is not pronounced when preceded by a vowel). However, it can be realised when followed by a vocalic sound (called linking /r/) (Hay & Sudbury, 2005; Hay, et al., 2008). /r/ could also be realised in a different environment where it is not orthographically present. Such a feature is called intrusive /r/. It is more likely realised across a word/morpheme boundary when there is a non-high vowel preceded by a vowel (Hay & Sudbury, 2005; Hay, et al., 2008). In the present study, the orthographically present /r/ is examined in the production of the Jordanian speakers of English living in Christchurch, NZ. Intrusive /r/ was not explored in this study because the data collected were not sufficient. In regard to Jordanian English, Kalaldeh (2016) stated that it was a rhotic variety where /r/ is realised across all phonological environments.

As was shown in Figure 27, the presence of /r/ was more visible in the production of both the "Older children" and "Fathers" groups (around 77% and 76% respectively) than the "Younger children" (63%). The absence of /r/ was more noticeable in the production of the "Younger children" generation (37%) while it was less in the production of the "Fathers" group (24%) followed by the "Older children" generation (23%). Such a difference across the generations indicates that the age of

71

arrival was a main factor in affecting the production of the speakers. Another piece of evidence that

supported the importance of the age of arrival were the phonological constraints of the

environments where /r/ could be realised. The model showed that /r/ was absent within the

"Younger children" group in a [V_#C] environment. This apparently occurs with native speakers of

non-rhotic NZ English when /r/ is preceded by a vowel and followed by a consonant (Hay &

Maclagan, 2012; Hay & Sudbury, 2005; Hay, Maclagan, & Gordon, 2008). Regarding the [V_#V]

environment, /r/ was phonologically realised. This environment, visually demonstrated in Figure 28,

reflected the phonological constraints of linking /r/. As stated in the literature, linking /r/ is usually

constrained within the [V_#V] environment (Hay & Maclagan, 2012; Hay & Sudbury, 2005; Hay,

Maclagan, & Gordon, 2008). This evidence affirms that the "Younger children" generation produce

/r/s more similarly to NZE speakers than their older Jordanian counterparts.

Another result was the realisation of /r/ by the "Older children" generation in the [V_#V]

environment either across two word-boundaries or within a one word-boundary where the internal

linking /r/ was expected to occur (as seen in Figure 28). This means that, similar to the youngest

group, these speakers produce their linking /r/ similarly to the native speakers of NZE. However,

Figure 28 displays that the rhoticity is also noticeable in the [V_#C] environment where one would

not expect to see /r/ in a prototypical NZE pronunciation. This could reflect that speakers are

transferring their first language rhotic feature when producing English. Hansen (2006) affirmed that

L1 phonological system plays a main role in affecting the L2 phonological acquisition especially in the

adulthood age. He also claimed that acquiring several phonological features in the syllable-final

position was more difficult than syllable-initially, even in the adolescent age. His claim was

reinforced by a study conducted by Sato (1984) about two Vietnamese adolescents acquiring

English.

Finally, the oldest generation of this study were clearly demonstrating an influence of their

L1 on their English realisations. This result supports Hansen's (2006) claim that speakers transfer

different features of their L1 phonological system to their L2 if their L2 acquisition is initiated during

adulthood. As observed in Figure 28, the L1 phonological system of these speakers was more visible than their L2 phonological system when producing English. The results of the logistic mixed model as shown in Table 8 showed that /r/ was significantly realised by the "Fathers" group in the [V_#V] and [V_#C] environments. In other words, the presence of /r/ in all phonological environments affirmed the rhoticity of these speakers' English. Another point supporting the claim that L1 is more powerful than L2 phonological system when producing L2 is that the absence of /r/ by the "Fathers" and "Older children" groups, was lower in comparison to the "Younger children" generations (24%, 23%, and 36% respectively). All of these clues consequently affirmed that acquiring L2 after the young age plays a main role in transferring speakers' L1 phonological system to their L2 production.

Chapter six

Conclusion

In conclusion, this study has examined the importance of the age of arrival on immigrants' acquisition of the host country's salient linguistic features. This study addressed the following questions:

1. To what extent does the age of arrival affect the production of the informants (Fathers, Older children, and Younger children) participated in the current research?

2. To what extent could NZE vocalic features be realised in the production of the informants who participated in the current research?

3. To what extent do speakers acquire the phonological constraints of the consonantal features?

4. Which sounds could be acquired similarly/differently to the native NZE speakers?

Question 1

Age of arrival evidently affects the production of immigrants who come as an adolescent or younger. Such a claim could be supported through looking at their English production mainly consonants. As discussed in 5.2 and 5.3, acquiring the glottal stop & tap as variants instead of /t/ and non-rhoticity was only noticeable in the production of the "Older children" and "Younger children" generations while it was almost absent in the production of the "Fathers" group.

Question 2

It seems that there are many NZE vocalic features which are acquired by immigrants of all ages. In this study not only the "Older children" and "Younger children" generations but also by the "Fathers" group produced vowels that were in line with New Zealand English vowels. Once again, the NZE vowel system was the most visible in the younger generations' speech in comparison to the other groups. This result shows the importance of age of arrival on the production of speakers.

Question 3

Though the vowels could be acquired because they are not phonetically constrained with particular phonological environments, acquiring consonantal features could be more difficult, especially if

immigration occurs during adulthood. Regarding adolescents, it seems that they can acquire not only simple features (vocalic) but also some more complex ones (consonantal). However, they may not be able to fully apply the constraints to all environments. This means that they may misplace several features when constraints come into view. The very young speakers are more able than adolescents their acquisition of the features of the dominant language. They seem to easily acquire the host country features with all of the constraints.

Question 4

Although there are many vocalic NZE features which are visible in the production of the most speakers (Fathers, Older children, and Younger children) groups, the consonants examined (/t/ variants and /r/ variants) are only similar to NZE speakers in the production of the "Younger children" generation whereas the "Older children" group had a mixture between prototypical NZE pronunciations and typical Jordanian Arabic realisations. The "Fathers" group, as discussed above, did not seem to have acquired NZE consonantal features.

Limitations of the study

The current study examined different variants (vowels, /t/ and /r/) but the sample size was small (n=9). Moreover, the sample of the study only examined male speech. The main concern of the present study was to shed more light on the age of arrival, rather than examining the role of the gender. I expect that conducting a study with a larger sample including females and males would provide more reinforced results. I believe that addressing other factors such as length of residency, religion, language attitudes, and ethnicity could provide a deeper understanding of how different social factors could affect second language acquisition.

Future research

Broadly speaking, there is no study providing more understanding about the vowel system of New Zealand English in the context of under 18 year olds. Such a study could indicate early changes occurring in NZE. Furthermore, the next Jordanian generations living in Christchurch seemingly show a shift toward the dominant language namely English. Thus, I believe that a study is required which examines their language maintenance and shift. It also appears that there could be a movement in

the Jordanian Arabic vowel system regarding the BATH and TRAP vowels. Al-Tamimi (2007), on the one hand, results that the BATH vowel in the Jordanian Arabic is identical to the TRAP vowel. The difference between both, as Al-Tamimi (2007) points out, is the duration. On the other hand, Kalaldeh (2016) reveals that the BATH vowel is a very low and back vowel while the TRAP vowel in my study was produed low and front. Such a movement requires more investigation. Finally, the current research did not provide data about the mechanism of the intrusive /r/ in the production of L2 speakers. As a result, further research is required to explore such an issue.

References

Adamuti-Trache, M. (2013). Language Acquisition Among Adult Immigrants in Canada: The Effect of Premigration Language Capital. *Adult Education Quarterly, 63*(2), 103–126. doi:10.1177/0741713612442804

Ahuja , P., & Vyas, J. (2016). Forensic speaker profiling: the study of suprasegmental features of Gujarati dialects for text–independent speaker identification. *Australian Journal of Forensic Sciences, 50*(2), 152-165. doi:10.1080/00450618.2016.1237547

Al-Ghalban, L. (2014). On phonological variations in Kafrelsheikh Egyptian Arabic. *DiG, 22*(1), 91–122. doi:10.1515/dialect-2014-0006

Alghamdi, M. (1998). Spectrographic Analysis of Arabic Vowels- A Cross-dialect Study. *J. King Suad University*, 3-24.

Alotaibi , Y., & Meftah, A. (2013). Review of distinctive phonetic features and the Arabic share in related modern research. *Turkish Journal of Electrical Engineering & Computer Sciences*, 1426-1439.

Al-Tamimi, J. (2007). Static and Dynamic Cues in Vowel Production: A Cross Dialectal Study in Jordanian and Moroccan Arabic. *Laboratoire dynamique du Langage – CNRS – Université Lyon 2*, 1-4.

Bauer, L. (1984). Linking /r/ in RP: Some facts. *Journal of the International Phonetic Association, 14*(2), 74-79.

Bauer, L., Warren, P., Bardsley, D., Kennedy , M., & Major, G. (2007). New Zealand English. *Journal of the International Phonetic Association, 37*(1), 97-102.

Bayard, D. (1990). Minder, Mork and Mindy? (-t) Glottalisation and Post-vocalic (-r) in Younger New Zealand English Speakers. In *New Zealand Ways of Speaking English* (pp. 149-164). Wellington: Victoria University Press.

Boersma, P., & Weenink, D. (2018). Praat: doing phonetics by computer [Computer program]. Retrieved from http://www.praat.org/

Brown, A. (1988). Linking, intrusive, and rhotic /r/ in pronunciation models. *Journal of the International Phonetic Association, 18*(2), 144-151.

Chambers, J., & Schilling, N. (Eds.). (2012). *The Handbook of Language Variation and Change* (2 ed., Vol. 129). John Wiley & Sons, Incorporated.

Docherty, G., Hay, J., & Walker, A. (2006). Sociophonetic patterning of phrase-final /t/ in New Zealand English. *Australian International Conference on Speech Science & Technology* (pp. 378-383). Australian Speech Science & Technology Association Inc.

Fiasson, R. (2016). Frication, Pre-aspiration and Tapping of Medial /t/ in New Zealand English. *Linguistic Society of New Zealand (Inc.)*, 47-70.

Fromont, R., & Hay, J. (2008). ONZE Miner: The development of a browser-based research tool. *Corpora, 3*(2), 173-193. doi:10.3366/E1749503208000142

Gnevsheva , K. (2015). Acoustic analysis in the Accents of Non-Native English (ANNE) corpus. *International Journal of Learner Corpus Research, 1*(2), 256-267. doi:: 10.1075/ijlcr.1.2.04gne

Gnevsheva, K. (2015). Variation in Passing for a Native Speaker: Accentedness in Second Language Speakers of English in Production and Perception. New Zealand: University of Canterbury.

Hago, O., & Khan, W. (2015). The Pronunciation Problems Faced by Saudi EFL Learners at Secondary Schools. *Education and Linguistics Research, 1*(2), 85-99. doi:10.5296/elr.v1i2.7783

Hamzah, M., Nashuha, N., & Abdullah, A. (2017). Explicit Phonetic Instruction in Pronunciation Teaching and Learning in Higher Education Settings: The Case of Voiceless Dental Fricatives /Ө/ and Rhotics /r/ For Chinese Learners of English. *International Conference on the Scholarship of Teaching and Learning* (pp. 130-140). Kedah, Malaysia: School of Education and Modern Languages, Universiti Utara Malaysia. Retrieved from http://repo.uum.edu.my/id/eprint/22565

Hansen, J. (2006). Investigating L2 phonology. In J. Hansen, *Acquiring a Non-native phonology: Linguistic Constraints and Social Barriers* (1st ed., pp. 7-39). London: Continuum International Publishing Group Ltd.

Hay, J., & Maclagan, M. (2012). /r/-sandhi in early 20th century New Zealand English. *Linguistics, 50*(4), 745 – 763. doi:10.1515/ling-2012-0023

Hay, J., & Sudbury, A. (2005). How Rhoticity Became /r/-Sandhi. *Linguistic Society of America, 81*(4), 799-823. Retrieved from http://www.jstor.org/stable/4490019

Hay, J., Maclagan, M., & Gordon, E. (2008). *New Zealand English.* (J. Beal, P. Honeybone, & A. McMahon, Eds.) Edinburgh University Press.

Holmes, J. (1994). New Zealand fappers: an analysis of "t" voicing in a sample of New Zealand. *English World-Wide*, 195-224.

Holmes, J. (1995). Glottal stops in New Zealand English - an analysis of variants of word-final-t. *Linguistics, 33*(3), 433-463. doi:10.1515/ling.1995.33.3.433

Holmes, J. (1997). *T-time in New Zealand.* Printed in the United Kingdom: Cambridge University Press.

Holmes, J., Roberts, M., Verivaki, M., & Aipolo, A. (1993). Language Maintenance and Shift in Three New Zealand Speech Communities. *Appl Linguist, 14*(1), 1-24.

Huthaily, K. (2003, July). Contrastive phonological analysis of Arabic and English. University of Montana. Retrieved from http://scholarworks.umt.edu/etd/8110

Joseph, B. (1999). Utterance-finality-Framing the issues. *4th Linguistics and Phonetics Conference. 2*, pp. 3-13. Charles University Press.

Kalaldeh, R. (2016). English Pronunciation Errors by Jordanian University Students. *Arab World English Journal, 7*(2), 394-416.

Khalil, S. (2014). Comparative Study of the Acoustic Vowel Space of Egyptian English Vowels and General American English Vowels. *Linguistic Portfolios, 3*, 75-90.

Kissling, E. (2013). Teaching Pronunciation: Is Explicit Phonetics Instruction Beneficial for FL Learners? *Latin American, Latino and Iberian Studies, 97*(3), 720-744. doi:10.1111/j.1540-4781.2013.12029.x

Milroy , J., & Milroy, L. (1985). Linguistic change, social network and speaker innovation. *J. Linguistics, 21*(2), 339-384.

Munro, M. J. (1993). Productions of English Vowels by Native Speakers. *Language and Speech*, 39 - 66. doi:10.1177/002383099303600103

Nagy, N. (2010). Boston (r): Neighbo(r)s nea(r) and fa(r). *Language Variation and Change, 22*(2), 241–278.

Natour, Y. S., & Wingate, J. M. (2009). Fundamental Frequency Characteristics of Jordanian Arabic Speakers.   *Journal of voice, 23*(5), 560-566. doi:10.1016/j.jvoice.2008.01.005

Natour, Y. S., Marie, B. S., Tadros, S., & Tadros, Y. K. (2011). Formant Frequency Characteristics in Normal Arabic-Speaking Jordanians. *Journal of Voice, 25*(2), e75-e84. doi:10.1016/j.jvoice.2010.10.018.

Nycz, J. (2015). Second Dialect Acquisition: A Sociophonetic Perspective. *Language and Linguistics Compass, 9*(11), 469–482. doi:10.1111/lnc3.12163

Revis, M. (2015). *Family Language Policies of Refugees: Ethiopians and Colombians in New Zealand.* Wellington: Victoria University of Wellington.

Roberts, M. (1999). Immigrant Language Maintenance and Shift in the Gujarati, Dutch and Samoan Communities of Wellington. Wellington: Victoria University of Wellington. Retrieved from http://hdl.handle.net/10063/1311

Roberts, M. (2005). "Immigrants' Attitudes to Language Maintenance in New Zealand". In *Languages of New Zealand* (pp. 248-270). Wellington: Victoria University Press.

Saadah, E. (2011). The Production of Arabic Vowels by English L2 Learners and Heritage Speakers of Arabic. Urbana-Champaign: University of Illinois.

Sato, C. (1984). Phonological Processes in Second Language Acquisition: Another Look at Interlanguage Syllable Structure. *A Journal of Research in Language Learning, 34*(4), 43-58. doi:10.1111/j.1467-1770.1984.tb00351.x

Sugiura, N. (1978). Further analysts of the data by akaike' s information criterion and the finite corrections. *Communications in Statistics, Theory and Methods, 7*(1), 13-26. doi:10.1080/03610927808827599

Tagliamonte, S., & Molfenter, S. (2007). How'd you get that accent?: acquiring a second dialect of the same language. *Language in Society, 36*(5), 649–675.

Tahiry, K., Mounir, B., Mounir, I., & Farchi, A. (2016). Energy bands and spectral cues for Arabic vowels recognition. *© Springer Science+Business Media, 19*(4), 707-716.

Taylor, B. (1996). Gay men, femininity and /t/ in New Zealand English. *Wellington Working Papers in Linguistics, 8*, 70-92.

Thomas, E. (2011). Vowels. In E. Thomas, *Sociophonetics: An introduction* (pp. 138-174). Basingstoke, Hampshire ; New York: Palgrave Macmillan.

Tyler , K., & Thomas, E. (2007). *NORM: The vowel normalization and plotting suite*. Retrieved from http://lingtools.uoregon.edu/norm/about_norm.php

Wagner, S. (2012). Age grading in sociolinguistic theory. *Language and linguistics Compass, 6*(6), 371-382. doi:10.1002/lnc3.343

Walker, A. (2014). Crossing oceans with voices and ears: second dialect acquisition and topic-based shifting in production and perception. Columbus: The Ohio State University.

Warren, P. (2017). Quality and quantity in New Zealand English vowel contrasts. *Journal of the International Phonetic Association*, 1-26. doi:10.1017/S0025100317000329

Watson, C., Maclagan, M., & Harrington , J. (2000). Acoustic evidence for vowel change in New Zealand English. *Cambridge University Press*, 51–68. doi:10.1017/S0954394500121039

Wells, J. C. (1982). *Accents of English.* Cambridge University Press.

Xue, S., Hao , G., & Mayo, R. (2006). Volumetric measurements of vocal tracts for male speakers from different races. *Clinical Linguistics & Phonetics, 20*(9), 691-702.