# AN INSTRUMENTAL ANALYSIS OF VOWELS IN MALACCA PORTUGUESE CREOLE

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**FACULTY OF LANGUAGES AND LINGUISTICS**
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# AN INSTRUMENTAL ANALYSIS OF VOWELS IN MALACCA PORTUGUESE CREOLE

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## UNIVERSITI MALAYA

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## ABSTRACT

This paper examines the vowel system of present day Malacca Portuguese Creole (MPC) which is in danger of extinction. The research questions that the study addresses are: (1) What are the characteristics of monophthong vowels in MPC based on their acoustic properties?; (2) To what extent are the MPC monophthong vowels found in this study similar to those described in the literature?; (3) How do the MPC monophthong vowels compare to similar vowels in Malay, Malaysian English and European Portuguese? Conversational data were collected from five female speakers, henceforth known as language consultants (LC), who are native speakers of MPC, and who have spent the majority of their lives in the Portuguese Settlement in Malacca. Vowels were extracted from the recordings as long as they did not have neighbouring nasals and approximants which may have affected the quality of targeted vowels. A total of 1083 monophthongs were extracted for analysis. The first (F1) and second formants (F2) and the duration of the vowels were measured using Praat version 5.2.04. Measurements were carried out using linear-prediction-based formant tracks overlaid on spectrograms of the targeted vowels. F1 and F2 values were measured at the mid-point of the vowels. The results suggest that there are six MPC monophthongs compared to the eight proposed previously, with a notable absence of /o/ and /ɛ/. Considerable variation was found within and between LCs in the way each of the vowels was produced. There were also noticeable overlaps between /i/ and /e/ suggesting that they were being used interchangeably by the LCs. The quality of some of the vowels found in this study was also found to be different from those previously described. In relation to Malay, Malaysian English and European Portuguese, MPC vowels were generally found to be closer to Malay in terms of vowel quality and inventory. The reduced vowel inventory of MPC compared to European Portuguese, albeit the current day variety,

reflects its status as a Creole. Based on the reduced vowel inventory, the variation in the way that vowels are produced, the overlaps between vowels and the possible influence from other local languages, the findings point towards the possible phonological instability of this endangered language. Further, they mirror the changes found in terms of vocabulary loss and substitution in MPC found by other researchers.

Keywords: Malacca Portuguese Creole, Kristang, phonetics, instrumental analysis, vowels, monophthongs.

# ABSTRAK

Disertasi ini mengkaji sistem vokal dalam Creole Portugis Melaka (MPC) yang hampir mengalami kepupusan bahasa. Soalan-soalan penyelidikan yang dikaji adalah: (1) Apakah ciri-ciri vokal monoftong dalam MPC berdasarkan sifat-sifat akustik?; (2) Sejauhmanakah vokal monoftong MPC dalam kajian ini memaparkan unsur-unsur yang sama seperti dinyatakan dalam babak kesusteraan terdahulu?; (3) Bagaimanakah vokal monoftong MPC berbanding dengan vokal yang sama terdapat dalam Bahasa Melayu, Bahasa Inggeris dan Portugis Eropah Malaysia? Data Perbualan dikumpul dari perbualan lima orang wanita, yang selepas ini dikenali sebagai perunding bahasa (LC), yang merupakan penutur asli MPC dan yang telah menetap di Kampung Portugis di Melaka sepanjang majoriti kehidupan mereka. Data vokal dipetik daripada rakaman selagi kualitinya tidak dijejas oleh bunyi nasal dan approximants bersebelahan vokal tersebut. Sebanyak 1083 monoftong dipetik untuk tujuan analisis. Formant pertama (F1) dan kedua (F2) dan tempoh monoftong diukur dengan menggunakan program Praat versi 5.2.04. Pengukuran dilakukan dengan menggunakan trek formant berasaskan ramalan linear yang dipaparkan pada spectrogram. Pengukuran F1 dan F2 adalah pada titik pertengahan vokal monoftong. Keputusan kajian menunjukkan bahawa terdapat enam monoftong MPC berbanding lapan yang dicadangkan sebelum ini. Penemuan menarik menunjukkan ketidakwujudan /o/ dan /ɛ/ vokal MPC. Penemuan ini bertentangan dengan keputusan pengajian sebelum ini. Terdapat perbezaan variasi dari cara penghasilan monoftong vokal bagi setiap LC and di antara mereka. Terdapat juga pertindihan ketara antara /i/ dan /e/ mencadangkan bahawa kedua-dua vokal monoftong digunakan secara berganti-ganti oleh LC. Kualiti beberapa vokal dalam kajian ini juga didapati bersifat berbeza daripada hasil kajian terdahulu. Dalam perbandingan antara Melayu , Bahasa Inggeris Malaysia, dan Portugis Eropah, vokal MPC pada umumnya

didapati kualiti vokalnya dan inventori vokalnya lebih mirip dengan Melayu. Pengecilan saiz inventori vokal MPC berbanding Bahasa Portugis Eropah kini mencerminkan salah satu ciri-ciri pengenalpastian MPC sebagai Creole berasas-Portugis. Berdasarkan saiz inventori vokal yang semakin berkurangan, perubahan dalam cara penghasilan vokal, pertindihan antara vokal-vokal dan pengaruh dari bahasa tempatan lain, ketidakstabilan fonologi MPC turut mencerminkan kemungkinan ancaman bahasa yang dihadapi bahasa ini. Tambahan lagi, kehilangan dan penggantian maksud perbendaharaan perkataan MPC juga digambarkan sama seperti yang dinyatakan dalan hasil kajian penyelidik lain.

Kata kunci: Creole Melaka Portugis, Kristang, fonetik, analisis berperalatan, vokal, monoftong.

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# CHAPTER 1

# INTRODUCTION

## 1.1 Background

Following the order of the King of Portugal Dom Manuel, the first official arrival of Portuguese in Malacca led by Captain Diogo Lopes de Sequeira on 28 of August 1509 was the starting point of the Portuguese-Malacca contact (Singho, 2009) but the maps of Malacca found in the ancient Portuguese navigators' written archive are evidence of the presence of the Portuguese in Malacca since the sixteenth Century. The Portuguese men were encouraged by their King, Dom Manuel, to marry local women in order to gain stronger influence in the Asian colonies (Baxter, 2005). Thomaz (1974, p. 81) states that "very rarely did they bring their families along..." and this echoes the fact that these men had the freedom of leaving their homelands without the burden of families and were more prone to settle down with locals. Unlike the Portuguese, the policy of encouraging their sailors to settle down with locals was not used by the Dutch and British when they came to Malacca later.

The result of the union between the Portuguese and locals in the 16$^{th}$ Century was as Baxter (2005, p.10) explains:

> "the creation of a *casado* class (European Portuguese officially married to local women), which produced stable bi- and multi-lingual *mestiço* populations loyal to Portugal. In such Asian settings Creole Portuguese arose".

Having established a new settler group of *casados* under the auspices of their King, the offspring began adapting languages from both Portuguese and local parentage in domestic contexts. Over generations, MPC is formed and passed on with a mixture of more stable language features. The *casados* in Malacca are one of the main factors why MPC survived through the test of time even through the Dutch and British colonisations.

## 1.2 The Portuguese Descendants in Malaysia

The following centuries saw further mixture with "Chinese, Indian, Malay, Dutch, Sri Lankan, Filipino and English elements" (Baxter, 2012, p.115). This group of Portuguese descendants are referred to as *Naserani*, *Serani*, Eurasians, Portuguese, *Kristang* (which refers to Christianity and is also used to refer to the language) and Portuguese-Eurasians (e.g. see Fernandis, 2003; Marbeck, 2004; 2012). Today the community has no direct Portuguese ancestral connection (e.g. unlike the Indians and Chinese in Malaysia) and have formed a new ethnic group in a new country. Thus, the Portuguese descendants in Malaysia do not carry a similar identity as Portuguese citizens do in Portugal. Similar to the *Makoa* Creole speakers in Madagascar, the new generations have no connections to the old country (Gueunier, 1990, n.d.:5; Harring, 2003, p. 20). Baxter (2012, p. 115) groups the Portuguese descendants by their wide range of ancestry background ranging from Portuguese, Indo-Portuguese, Malayo-Portuguese and also a huge number of camp followers who arrived at Malacca during the transition from Portuguese to Dutch during 1641. Officially the Portuguese and its troops of navy members were in Malacca from 1509 to 1641, highlighting a great extent of Portuguese influence to the people in Malacca.

The estimated number of Portuguese Eurasians in Malaysia is approximately 15,000 (Gomes, 2003) but the MPC speaking population in the Portuguese Settlement is estimated by Lee (2004), to be lower than 1000 people comprising 118 homes (Baxter, 2005). The number of Portuguese descendants who speak the Creole, henceforth referred to in this study a Malacca Portuguese Creole or MPC, has declined over the years due to mixed marriages, urbanisation, education and socio-economic and geographical mobility, and in most cases, English has taken over as the home language (Pillai & Khan, 2012).

MPC is actively used in this contained area where there is a concentration of Portuguese descendants in the Portuguese Settlement in Malacca, in the central region of Peninsular Malaysia. The formation traces its history to 1926 when two Catholic priests, Rev. Father Alvaro Martin Coroado and Rev. Father Jules Pierre François gathered the Portuguese descendants who used to live in Praya Lane, Tranquerah and other parts of Malacca who were in need of a land to live together (Sta Maria, 1991). 26 acres land (Ang, 1974, p.28) initially named *"Padre sa chang"(*Sta Maria, 1991, p. 6) or *"Padri Sa Chang"* (O'Neill, 2008, p. 4) which literally means 'the priest's land' was obtained from the British administrators.

In the 20th Century, the Portuguese descendants in *Padri Sa Chang* earned their living as fishermen. Thomaz (1974) pointed out that the majority of the 7,400 Christians living in the territory of Malacca were living in extreme poverty while depending on the assistance of the *padre* (known as 'father' or 'priest') of the Society of Jesus (Thomaz, 1974, p. 99). Now, commonly known as the Portuguese Settlement, or *Kampung Portugis* in Malay, the Settlement has approximately 1000 residents.

From the time it was formed, the Portuguese Settlement formed its contained zone which also allowed people of portuguese descent to continue to communicate in the Creole among themselves. Besides the language, cultural and religious practices have also been maintained within the community. Today, there is a small chapel, a school, multimedia utility room, and a section of the land assigned for restaurants serving Portuguese-Eurasian food. For example, the cultural practice of ringing the village bell is still practised to signal a death in the largely Roman Catholic Community, and festivals, like *Intrudu* (a water festival preceding Lent) and *Festa San Pedro* (the Feast of Saint Peter), are still celebrated in the Settlement.

However, even in here, there is evidence of language shift from MPC to English especially among younger speakers (e.g. David and Faridah Noor Mohd Noor, 1999; Lee, 2003; Nunes, 1996; Sudesh, 2000), and this is not surprising as there appears to be a lack of inter-generational transmission even among the families living in the Settlement (Pillai, Soh & Kajita, 2014). As pointed out by Baxter (2012, p. 115), MPC is "the last vital variety of a group of East and Southeast Asian Creole Portuguese languages". In fact it is considered one of the endangered languages in Malaysia in the UNESCO Atlas of the World's Languages in Danger (Moseley, 2010).

### 1.3 MPC as a Creole

Holm (2000) explains that a pidgin is formed using a reduced language structure due to language contact between people with initially no common language for social, political, or trading interactions. Over time, during the interaction the less powerful group of people, or speakers of substrate language, tend to accommodate and adopt

lexical items which were largely from the dominant language, known as the superstrate language (Sebba, 1997, p. 25). The other language features such as inflections, tenses, and prepositions, will tend to be left out because only message delivery was the main intention of such communication. Hymes (1971, p. 15), therefore, defines pidgin as having a very restricted language purpose limited to the domain of communication for trading and of having no native speakers. According to Holm (2002) the two main characteristics of pidgins is that social distance between the superstrate and substrate communities is maintained and both the languages in contact are not closely related. However, these pidgin form of languages tends not to become established or gain any recognition in society because it is not the main language for communication and has no significant heritage of identity importance to neither group of superstrate and substrate speakers.

In contrast, a Creole is a form of reduced language spoken as a native language by a speech community whose ancestors were brought to new places, mainly as the result of slavery (Holm, 2000, p. 6), a change of military or political authority and New World immigration (Haring, 2003, p. 20). For example, the Seychelles in the twelfth Century consists of ethnical mixture with African, French, Chinese and Indian origins due to the *coup d'etat* condition in the disposition of the original governmental authority (Haring, 2003, p.20). Over time, the influx of people from various linguistics backgrounds to new environment formed a new 'creole society' (Haring, 2003).

In the case of MPC, similar to other Asian contexts, the Portuguese conquest of Malacca was largely due to trade. Malacca was already a thriving multilingual setting. As Baxter (1990, p. 163) maintains, "(i)n Asia, Creole Portuguese was rarely the sole

language of any of its speakers". When creole is formed it allows remodelling and adaptation of new languages by people who initially do not share similar spoken language (Haring, 2003, p. 20). As the Portuguese formed unions with the locals in Malacca, and had children, the younger generations began to speak creole as their native language and it continued to be passed on from one generation to another. Nevertheless, MPC would have existed together with Malay and other local languages used in Malacca. Hence, MPC displays considerable influence from Bazaar Malay (Holm, 1989).

Thus, contrary to popular belief, MPC is not an old form of Portuguese but has evolved over the years from sixteenth Century Middle Portuguese, *Português Médio* (Galves, Namiuti and Paixão de Sousa, 2006) or Hispanic Portuguese, *Português Hispânico* (Galves et al., 2006) to its unique language form in the current days. The fact that the Portuguese descendants in Malacca have lost their direct ancestral connection as mentioned in 1.2, the Portuguese grammar changes which were suggested to have occurred in the seventeenth Century (Martins, 1994) or in eighteenth Century (Galves and Galves, 1995; Galves, 2004) in Portugal would have had no direct influence to MPC during the similar timeline. Instead, MPC displays features of creoles such as: the lost of lexical items and semantic shift, the lack of tense indication which is similar to other local languages, and a reduced phoneme inventory. The comparison of Rêgo (1942) and Baxter and de Silva's (2004) lexical collection indicated that 9.3% of lexical loss and 1.5% semantic shift (Baxter, 2012, p. 123) across the time-lapse of almost six decades. The absence of determiners in syntax is noticed for example in *kobra pesonya* "snake poison" in which the lack of determiners does not affect the meaning delivery of "snakes are poisonous" (Baxter, 1988, p. 88). It is also noticed that MPC normally uses

verbs with third person singular tense, unlike Portuguese language consisting of an extensive listing of verbs for first person singular and first person plural forms, second person singular and second person plural forms, third person singular and third person plural forms. The Time-Mood-Aspect of auxiliary complex is displayed by the usage of *ja, ta,* and *logu* to represent past, present and future tenses similar to Malay representative of "*sudah, sedang,* and *nanti*" (Baxter, 1988, p. 119). The reduced phoneme of MPC, especially in vowel reduction is prominent. The 8-vowel inventory proposed by Baxter (1988) indicated a much reduced vowel in comparison to EuPt, which similarly is noticed in other Portuguese Creoles in Asian and African regions.

## 1.4 Statement of Problem

Current observation on the existing publications on MPC indicates a lack of uniformity in the way that the sounds of MPC are described. The confusion partly derived from a lack of a standardised orthographic form for MPC. The use of symbols to represent sounds are also confusing as different authors use different representations for some of the sounds, and there appears to be a mixture of spelling and IPA symbols used (see 2.10). There is also a sense of the MPC sounds being anglicised perhaps because of the language backgrounds of the authors (e.g. Scully & Zuzarte, 2004). Such contradiction in sound-spelling and phonetic representation impedes efforts to document, and produce learning materials for MPC, including dictionaries. This is not a good sign for an endangered language like MPC.

## 1.5 Objectives of Study

In part, the contradiction in the description of MPC sounds may be because they are based on impressionistic analysis, such as Baxter's (1988) analysis of MPC sounds. Further to the initial attempts to acoustically investigate the pronunciation variation of MPC speakers (Chan & Pillai, 2011), aresearch gap in studies related to the description of MPC sounds, especially the acoustic analysis of MPC sounds, was observed. This study, therefore, aims to instrumentally examine one part of the sound system of present day MPC spoken in the Malacca Portuguese Settlement. The present study focuses specifically on examining the monophthong vowels of MPC as there appears to be discrepancies in the current descriptions of MPC vowels (see 2.5).

## 1.6 Research Questions:

In relation to the aims and focus of this study, the following research questions were addressed :

1. What are the characteristics of monophthong vowels in Malacca Portuguese Creole based on their acoustic properties?

2. To what extent are the MPC monophthong vowels found in this study similar to those described in the literature?

3. How do the MPC monophthong vowels compare to similar vowels in Malay, Malaysian English and European Portuguese?

## 1.7 Significance of Study

The present study hopes to add to previous description of MPC sounds by complementing these impressionistic studies and explaining some of the contradictions found in these descriptions. The recordings will also contribute to the documentation of the sounds of present day MPC via easily accessible archive such as the Endangered Languages Archive (Pillai, 2013).

## 1.8 Organization of Dissertation

With the research targets explained earlier, this thesis will be presented with the flow of five chapters. The first chapter outlines the objective and purpose of this study. The second chapter reviews the literature on MPC sounds while reflecting the research gap from what has already been done and which direction requires further researches. The third chapter focuses on the methodology used in this study, while the fourth chapter presents and discusses the findings. The final chapter summarises the findings in relation to the research questions and discusses the limitations of the present work whilst providing suggestions for future research in the area.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Introduction

This chapter begins with a description of MPC vowels based on previous studies. This is followed by a description of Malay and Malaysian English and European Portuguese vowels to enable comparisons with MPC. The features of other Portuguese Creoles in the Asian and African regions are also discussed. This chapter also discusses the literature on the acoustic analysis of vowels. Lastly, there is a discussion on the choice of orthography in the current study.

## 2.2 MPC as a Creole

Baxter (1988, p. 3) explains that MPC is a Portuguese-based creole that was developed during the "Portuguese colonial expansion during the fifteenth and sixteenth centuries" together with other such creoles in Asia and Africa. These creoles in Asia and Africa share many features but at the same time developed features unique to their linguistic environment (ibid.). Although as mentioned in 1.2 and 1.3, there are different periodical categorizations of new Portuguese grammar, as proposed by Martins (1994), Galves and Galves (1995), Galves (2004), Galves, Namiuti and Paixão de Sousa (2006), Galves et al. (2006), they were all of the similar view that MPC behaves as a Creole which gradually developed from its sixteenth Century Media Portuguese or Hispanic Portuguese form. During this period of expansion the Portuguese policy was to encourage unions with locals, which in turn led to "stable bi- and multi-lingual mestiço

populations loyal to Portugal. In such Asian settings Creole Portuguese arose" (Baxter, 2005, p. 10). Thus, MPC grew to have native speakers as the unions produced off-springs. Unlike pidgins which are known for its simple structures solely for communicative purposes across people of various language backgrounds, creoles are more complex in their morphological and phonological structures (Haja Mohideen Bin Mohamed Ali & Shamimah Mohideen, 2008).

As mentioned in Chapter 1 (see 1.3), MPC, popularly known as *Kristang*, is spoken by Portuguese-Eurasians in Malaysian and Singapore. Contrary to the misconceptions of Kristang as a sixteenth century form of Portuguese or "Portugis mutu antigu [very ancient Portuguese]" (from Pillai, 2012), it is a language that derived its vocabulary from 16$^{th}$ Century Portuguese but that evolved into a language in its own right over the last 500 years. Having evolved in a multilingual setting, the vocabulary and grammar of MPC is also influenced by Malay and other local languages. As Baxter and de Silva (2004, p.vii) point out, MPC is "a Creole language, a language born of the contacts between speakers of Portuguese and speakers of local and other languages".

For example, like Malay, MPC has reduplication of nouns such *krenkrensa* for children (Baxter, 1988, p. 102). Also, similar to the function of Malay *'belum'* and *'jangan'*, MPC uses *nenang* and *nang,* to express the negation of 'have yet' and 'do not' (Baxter, 1988, p. 222). In terms of vocabulary, MPC words borrowed from Malay include *champurah* 'mix' from the Malay word *campur*, whilst *chengsi* meaning 'spatula' was borrowed from Hokkien *chien*$^{1}$ *si*$^{5}$ 'small spoon'. In relation to word order, Haja Mohideen Bin Mohamed Ali & Shamimah Mohideen (2008, p. 8), provide the example of noun phrase order in MPC which is similar to Malay, such as in *achar chilli* 'pickles + chilli' and *cha tal* 'tea + plain' where the noun precedes the adjective. In English, the

adjective would precede the noun, as in ‘chilli pickles’ and ‘plain tea’. The sixteenth Century Portuguese had both of the noun-adjective and adjective-noun noun phrase orders. The noun-adjective phrase order similar to Malay could have been adopted in MPC due to close proximity with Malay speakers in Malacca in comparison to the word order in English and other European languages’. Hancock’s (1975, p. 219) observation on MPC also raised examples of the usage of possessive –’s genitive indicating ownership, such as in yo sa ‘mine’ [saya punya] and bo sa ‘yours’ [awak punya]. This is similar to the Malay syntax structure of punya ‘someone’s own’. These grammatical, lexical, and phonological features did not solely originate from Portuguese, and this shows that MPC is a creole with its own features setting it aside from Portuguese.

## 2.3 Malacca Portuguese Creole and its Endangerment

As discussed in Chapter 1 (see 1.2), the younger generations of Portuguese Eurasians have shifted away from MPC due to a variety of factors such as the education policy, inter-ethnic marriages, and urban migration away from Malacca for better educational and employment opportunities (Baxter, 2005; David & Faridah Noor Mohd Noor, 1999; Lee, 2003, 2004; Pillai, Soh & Kajita, 2014; Sudesh, 2000). Haja Mohideen Bin Mohamed Ali & Shamimah Mohideen (2008) also mentioned the perception of younger Portuguese-Eurasian generations that MPC usage has insignificant impact in their future, and thus, they do not see the urgency in preserving their language heritage. MPC is also showing signs of disappearing lexical items, wider usage of Malay and English forms (Baxter 2012), and variation in pronunciation (Chan & Pillai, 2012), which highlight the extent of its endangerment.

## 2.4 Previous Studies on Malacca Portuguese Creole

Compared to many other Portuguese-influenced Creoles around the world, there is a dearth of linguistic research on MPC. The few existing studies focus on the lexicon and grammar in Malacca Portuguese Creole as well as the socio-cultural aspects of the Eurasians (e.g. Marbeck 1994; 1995). For example, the lexicon of MPC was described by Rêgo (1998[1942]) and Hancock (1973), while Baxter and de Silva (2004) produced a dictionary of Kristang. MPC grammar has been discussed by Rêgo (1998[1942]), Hancock (1969; 1973; 1975), Baxter (1988), and Nunes (1994; 1996). In addition, David and Faridah Noor Mohd Noor (1999), Sudesh (2000) and Lee (2003; 2004) conducted studies on language shift and language maintenance. Marbeck (1995; 1996; 2004; 2012) has also produced phrasebooks of MPC and other publications intended to revive MPC.

## 2.5 Malacca Portuguese Creole Sounds

Baxter (1988) described MPC as having the consonants presented in Table 2.1. Baxter explains that /v/ occurs infrequently in MPC which is also similar to Malay, where /v/ generally occurs in borrowed words. Baxter's consonant inventory does not include /w/ and /j/ which appear in Hancock's (1973) description of MPC consonants.

Table 2.1: MPC Consonants

(Reproduced from Baxter, 1988, p. 20)

| | |
|---|---|
| Stops | p b t d k g |
| Fricative | f (v) s z |
| Affricates | tʃ dʒ |
| Approximants | l r |
| Nasals | m n ŋ ɲ |

Hancock (2009) states that MPC has eight vowels, but says that only six of them are contrastive. These MPC vowels are /i/, /e/-/ɛ/, /a/, /ɔ/-/o/, /u/ and /ə/ (Hancock 2009, p. 298). The MPC vowel chart (see Figure 2.1) in Klein (2006, p. 9) was produced based on Baxter's (1988, p. 23) description (refer Table 2.2). Baxter (1988, p. 24) also presented a five degree chart system to describe vowel height, advancement and rounding for MPC (see Table 2.3).

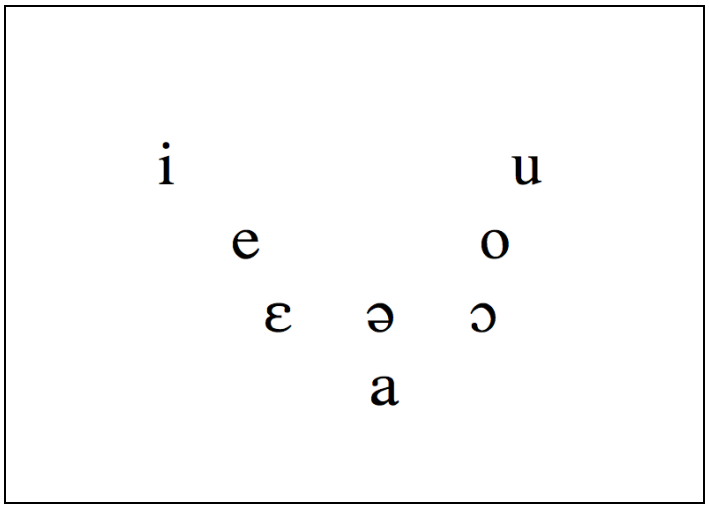


Figure 2.1: MPC vowel

(Reproduced from Klein, 2006, p. 9)

Table 2.2: MPC Vowels

(Reproduced from Klein (2006, p. 9) and Baxter (1988, p. 23))

| | **Unrounded** | | **Rounded** |
|---|---|---|---|
| | **Front** | **Central** | **Back** |
| **High** | i | | u |
| | e | | o |
| **Mid** | ɐ̝<br>(æ) | ë | ɒ |
| **Low** | | a | |

Table 2.3: Five Degrees of Malacca Portuguese Creole Vowel Height

(Reproduced from Baxter, 1988, p. 24)

| | **i** | **e** | **ɐ̝** | **æ** | **ë** | **a** | **ɒ** | **o** | **u** |
|---|---|---|---|---|---|---|---|---|---|
| **Height** | 5 | 4 | 3 | 2 | 2 | 1 | 3 | 4 | 5 |
| **Back** | - | - | - | - | + | + | + | + | + |
| **Round** | - | - | - | - | - | - | + | + | + |

However, the status of /e/, /ɛ/, /ɔ/ and /o/ is not clear. They are said to be contrastive and therefore, we would assume they are separate phonemes in MPC and occur in minimal pairs. However, Hancock (2009, p. 298) only explains the contrast for /e/ - /ɛ/, where he says: "There are two words where (e) and (e) are contrastive, viz. *pétu*

([pɛtu]), ‘chest, breast’, and *pétu* (['**e**tu]), ‘near’ (Ptg. peito and perto)”. Hancock orthographically represents /ɛ/ and /e/ as *e* (e.g. *pétu* ([p**ɛ**tu]), and *pétu* (['**e**tu]) while Baxter (1988, p.25) orthographically transcribes the vowel in the MPC word for ‘near’ as *pẹtu*. Later in Baxter and de Silva (2004, p. xii), an accent above the letter e is used to differentiate the two vowels. Thus, the MPC word for ‘chest’ is written as *pêtu*, pronounced, according to Baxter and de Silva (2004, p. xii) as [e] while the word for ‘near’ is written as *petu* (but appears as *pẹ́tu* in Baxter, 1988) and pronounced as [ɛ]. Two issues arise here. One is that both words have the different variant of the vowel in Baxter and de Silva (2004) and Hancock (2009). The other issue is that although both similar in terms of vowel quality, and are sometimes regarded as the same sounds, /e/ occurs higher than /ɛ/ in the vowel space. It is interesting to note that Baxter says that the *e* in *pêtu* is pronounced close to the *e* in British English *pear*.

Baxter (1988, p. 26) further explains that the variation in the use of the two vowels could be an effect of the vowel preceding /r/ being realised as what we assume to be /ɛ/ (based on his transcription of [pẹ́tu] and his vowel table (ibid, p. 23). However, he points out that “clear cut cases of contrast are few and seem to be restricted to three environments: before /t/, /s/ and /z/”. Nevertheless, his examples in Table 2.4 do not show how this distinction is made as the examples contain both variants of the vowel occurring in the same environment thus begging the question of whether these vowels are minimal pairs (e.g. English *pet* and *pat*) only before /t/, /s/ and /z/ which seems to be what Baxter (1988) is suggesting. He goes on to say that this distribution of /e/ and /ɛ/ is not systematic although there are “preferred environments” (Baxter, 1988, p. 26). These are as follows (ibid.) and from the examples given it would seem that these vowels may be in allophonic variation rather than functioning as separate phonemes. However, they

are presented as separate phonemes in vowel table presented by Baxter (1988, p. 23). Since Klein (2006, p. 9) in his study of the phonology typology of Creole vowels based his MPC data on Baxter (1988), MPC is placed under the category of Creoles with an eight-vowel inventory similar to Sri Lankan and St Lucian Portuguese-based Creoles.

Table 2.4: /e/ and / ɛ/ Contrast before /t/, /s/ and /z/

(Reproduced from Baxter, 1988, p. 26)

| /e/ phoneme | | /ɛ/ phoneme | |
|---|---|---|---|
| /besu/ | 'lip' | /mɛsu/ | 'still' |
| /retu/ | 'correct' | /kɛtu/ | 'quiet' |
| /tezu/ | 'tight' | /rɛzu/ | 'prayer' |
| /azeti/ | 'oil' | /sɛti/ | 'seven' |
| /leti/ | 'milk' | | |

Baxter (1988) also suggests that the distribution of these vowels is an effect of vowel harmony, which once again supports the notion of vowels being in allophonic variation. Baxter suggests that the use of /e/ and /ɛ/ are influenced by the height of the following vowels. For example, if the vowel in the following syllable is a low vowel like /a/, the lower /ɛ/ tends to be used whereas if a higher vowel such as /u/ follows, then the higher /e/ is used. A similar explanation is provided for the use of what Baxter transcribes as o and ǫ, presumably /o/ and /ɔ/. Here, if the following vowel is a high one like /u/, then higher /o/ is used such as in *sógru* 'father-in-law' and *bólu* 'cake' (Baxter, 1988, p. 28). In contrast, lower /ɔ/ is used if a low vowel such as /a/ follows. Examples of such use from Baxter (1988, p. 28) are *bǫ́la* 'ball' and *tǫ́ka* 'touch'.

Further, similar to /e/ and /ɛ/, the distribution of /o/ and /ɔ/ depends on where it occurs. In this case, Baxter (1988, p. 27) states that these phonemes only contrast before /t/, /d/ and /l/, and also in particular "preferred environments" (Baxter, 1988, p. 26), such as the examples given in Table 2.5.

Table 2.5: /o/ and /ɔ / Contrast before /d/, /t/ and /l/

(Reproduced from Baxter, 1988, p. 27)

| /o/ phoneme | | /ɔ/ phoneme | |
|---|---|---|---|
| /goli / | 'marble game' | /mɔli/ | 'soft' |
| /dodu / | 'crazy' | /bɔdu/ | 'edge' |
| /anoti/ | 'night' | /bɔdru/ | 'edge' |
| | | /sɔti/ | 'type' |
| | | /sɔrti/ | 'type |

In relation to the schwa in MPC, Baxter (1988, p. 28) states that it has a complex status for being both "a phoneme and a positional variant of /a/ is unstressed syllables". He suggests that thus, contrary to Batalha (1981), this vowel does occur in MPC. Hancock (2009, p. 298-299), on the other hand, states that "/ə/ is articulated as a half-close back vowel with lip spreading, especially in final position; otherwise it is articulated in mid-central position". However, this distinction remains understudied and unreported. Baxter (1988) highlights the connection between the reduced vowel and stress in word final position. In unstressed syllables, /a/ tends to be realized as /ə/. What is meant here is probably that orthographic 'a' is realised as /ə/ in an unstressed syllable. This vowel is also produced in rapid speech such as in the following example from Baxter (1988, p. 29): *kazá* 'marry' /kaˈza/ compared to *kazamintu* 'wedding' is /kazəˈmintu/.

Thus far, none of the descriptions of MPC vowels indicate the existence of vowel contrast in terms of vowel quality or vowel length in MPC. This is similar to Malay vowels where there is no vowel length contrast (Asmah Omar, 1977; Maris, 1980, p. 9).

## 2.6 Influences of other Languages on MPC

As a creole that evolved in a multilingual environment, MPC has had contact and influences from local and other languages over time apart from the initial contact with Portuguese. These include Malay, English, Indian languages, Chinese dialects and Dutch (Baxter & Silva, 2004). In present day MPC, it is likely that Malay and Malaysian English (MalE) have the largest influence on MPC sounds. This is because Malay is not only the national language in Malaysia but is also the local lingua franca in most areas including Malacca. As for English, recent studies (David & Faridah Noor Mohd Noor, 1999; Lee, 2003, 2004; Pillai, Soh & Kajita, 2014; Sudesh, 2000) have shown that English is taking over as the first or dominant language among those below forty. The present day English spoken by the Portuguese Eurasians is most likely to be the local variety of English (see Pillai, Don, Knowles & Tang, 2010).

### 2.6.1 Malay

The current day MPC shared the following vowels with Malay. Standard Malay contains six monophthongs /i/, /e/, /ə/, /u/, /o/ and /a/ (Asmah Omar, 1993; Teoh, 1994; Maris, 1980). Table 2.6 displays the Standard Malay vowel inventory from Teoh (1994, p. 7).

Table 2.6: The Standard Malay Vowel Inventory

(Reproduced from Teoh, 1994, p. 7)

| | | |
|---|---|---|
| i | | u |
| e | ə | o |
| | a | |

Results from acoustic analysis of Malay vowels based on three female Malay native speakers from central Klang Valley of West Malaysia, by Yusuf (2013, p. 274) are presented in Table 2.7 and Figure 2.2.

Table 2.7: F1 and F2 values for Malay
(Reproduced from Yusuf, 2013, p. 274)

| Formants | i | e | ə | a | u | o |
|---|---|---|---|---|---|---|
| Ave. F1 (Hz) | 428 | 567 | 583 | 948 | 468 | 579 |
| Ave. F2 (Hz) | 2703 | 2417 | 1889 | 1706 | 1028 | 583 |

Ave. = Average

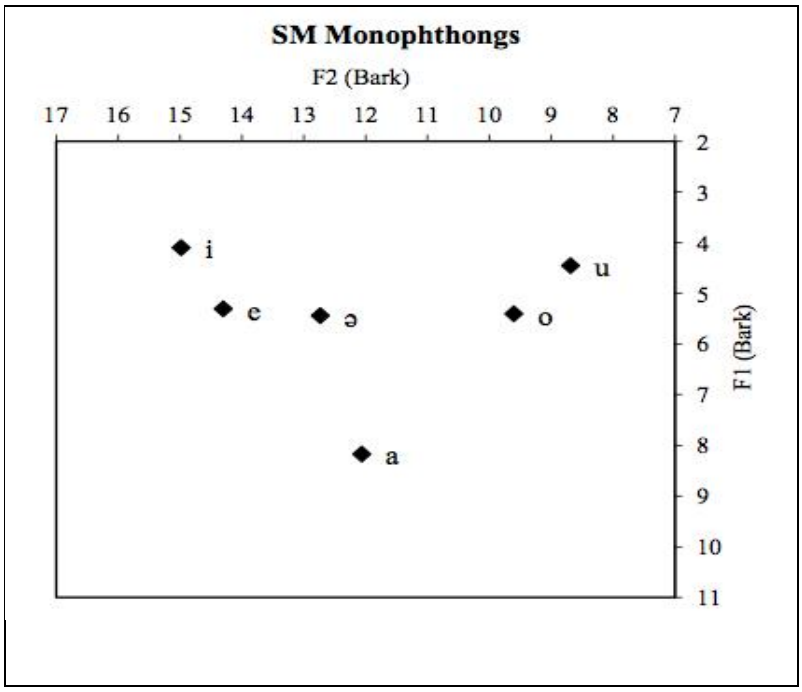


Figure 2.2: Malay Monophthongs
(Reproduced from Yusuf, 2013, p. 274))

Hancock (1975, p. 219) stated that MPC and Malay share common traits of "near-identical set" for /f/ - /p/ and /v/ - /b/ in MPC, in words such as sufra – supra 'suffer' and uvida - ubida 'ear' co-exist without affecting its meanings. Meanwhile, Baxter (1988, p. 24) mentions that MPC shares the same characteristic of Malay where orthographic 'a' (see 2.5) in word-final position can be realised as /a/ or /ə/. In Malay, however, this is related to regional differences, with the northern states in Peninsular Malaysia and the two states in the island of Borneo tending to realise it as /a/ while the rest tend to use /ə/ (Asmah Omar, 1977). For example, *mana* 'where' and *mengapa* engapacan be realized as /manə/ and /məŋapə/.

### 2.6.2 Malaysian English

English is one of the three official languages in Malaysia. Malaysian English (MalE) is the "umbrella term" for all the varieties of English used by Malaysians of various ethnic and social groups (Pillai, Don, Knowles and Tang, 2010, p. 159). Earlier studies on MalE pronunciation found more marked linguistics features by English speakers from Malay-medium schools compared to those from English-medium schools (Platt and Weber 1980, p. 168-169). In present day Malaysian English, speakers can switch from, for example, a more colloquial form of MalE to a more acrolectal variety provided they have both in their linguistic repertoire (Pillai, 2008a, p. 42). Malaysian speakers have also been known to switch between different ethnic accents.

Acoustic analysis of MalE vowels has indicated a possibly smaller vowel inventory due to the lack of quality contrast. For example, a lack of vowel contrast has been found between the vowel pairs /ɪ/ and /i:/, /e/ and /æ/, /ʌ/ and/ɑ:/ (Pillai, Don, Knowles, and

Tang, 2010) as shown in Table 2.8 and Figure 2.3. Tan and Low (2010), who looked at Malay speakers, suggest that this lack of contrast may be due to the influence of Malay which does not have this phonemic distinction. However, this same phenomenon was found in Pillai et al (2010) which examined speakers from three ethnic groups, which suggest that this is a common feature among Malaysian speakers, rather than a result of L1 influence, in this case, Malay.

Table 2.8: Average F1, F2 values, ED and duration of ME Vowels
(Reproduced from Pillai et al., 2010, p. 165)

| | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) | Euclidean Distance | Duration (ms) |
|---|---|---|---|---|---|---|
| iː | 316 | 2829 | 3.07 | 15.26 | 4.66 | 168 |
| ɪ | 373 | 2653 | 3.60 | 14.87 | 4.04 | 100 |
| e | 824 | 2112 | 7.31 | 13.45 | 2.44 | 112 |
| æ | 895 | 2078 | 7.81 | 13.35 | 2.70 | 132 |
| ʌ | 870 | 1419 | 7.64 | 10.83 | 1.93 | 119 |
| ɑː | 897 | 1357 | 7.83 | 10.53 | 2.22 | 211 |
| ɒ | 806 | 1200 | 7.19 | 9.70 | 2.26 | 128 |
| ɔː | 641 | 1021 | 5.92 | 8.65 | 2.87 | 129 |
| ʊ | 472 | 1237 | 4.49 | 9.90 | 2.10 | 82 |
| uː | 410 | 1026 | 3.94 | 8.68 | 3.41 | 107 |
| ɜː | 584 | 1543 | 5.45 | 11.39 | (0.41) | 167 |
| Average | 644 | 1680 | 5.84 | 11.51 | 2.86 | 132 |

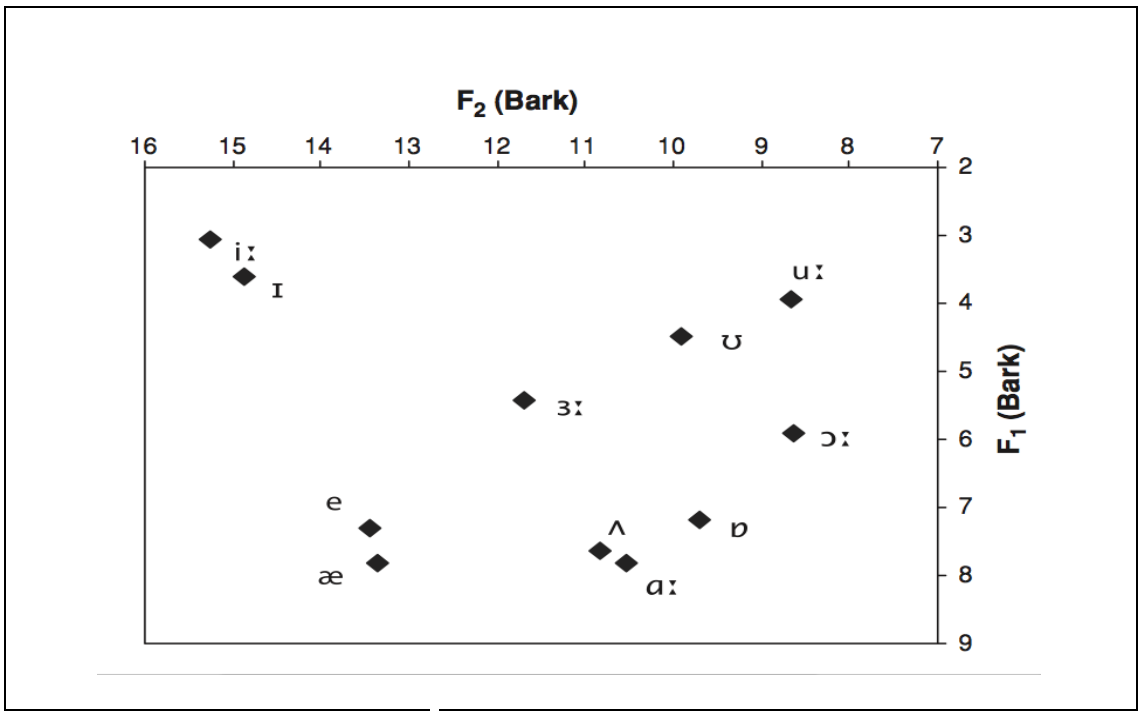


Figure 2.3: Malaysian English Vowel Chart
(Reproduced from Pillai et al., 2010, p. 165)

### 2.6.3 European Portuguese

In the sixteenth Century when the Portuguese navigators arrived in Malacca, Portuguese was introduced to the locals, a language which had also been picked up already by the slaves and sailors hired along their earlier destinations such as Goa, India. The Portuguese spoken by these people due to language contacts possessed characteristics from the mixture of their native languages and Portuguese they picked up over time.

Even within Portugal, there are notable varieties of regional differences in which each carries unique pronunciation features. Cintra (1971, p. 8) proposed to group Portuguese dialects by three general zones from northern Portugal towards southern Portugal, which are the *galegos* 'galician dialect', *portugueses setentrionais* 'setentrional or northern portuguese' and *portugueses centro-meridionais* 'centro-meridional or southern portuguese' across Portugal. For example, the Northern dialects of Portugal are distinguishable, apart from the Lisbon and Coimbra dialects, from the other two

dialectal zones, by its tendency of pronouncing both /b/ and /v/ as /b/. The dialectal differences from the Archipelago of Azores and Madeira are generally grouped as the fourth zone *portugueses insulares* 'island portuguese'. Martins (2003) gave the example of the São Miguel dialect among the archipelago dialects which pronounces /o/ with front-rounded /ø/, as in /øtra/ *outra* 'other'. When speakers from different regions of Portugal navigated beyond Europe during the expansion period, various dialectal features spread across the continents, further influencing the formation and development of Portuguese Creoles over the centuries.

Although dialectal differences in the Portuguese language existed at the time the Portuguese arrived in Malacca, the Portuguese spoken in the sixteenth Century would have been considerably different from Modern European Portuguese. Based on the timelines by authors such as Galves et al. (2006), Galves and Galves (1995), Galves et al. (1998), and Galves (2012) the beginning of Modern European Portuguese can be traced to around the eighteenth and nineteenth Centuries. Thus the sixteenth to seventeenth Centuries Portuguese in Malacca was very different from Modern European Portuguese, although some similar language features could have been noticed from both geographical locations, after going through similar language evolution coincidently. In addition, European Portuguese is a different variety from Brazilian Portuguese (BrPt). EuPt and BrPt had common ground until the eighteenth century, as proposed by Galves, Namiuti and Paixão de Sousa (2006), after which BrPt begin to branch out with its unique forms in the seventeenth Century, namely the BrPt pronunciation.

Given the passage of time and the nature of creoles (see 2.5), the MPC vowel inventory is smaller compared to even current day Portuguese. EuPt contains eight stressed oral

monophthongs: /a/, /ɐ/, /ɛ/, /e/, /ɔ/, /o/, /i/ and /u/. Table 2.9 presents these Portuguese vowels.

Table 2.9: European Portuguese Monophthongs

(Adapted from Oxford, 2001, p. vii)

| **Phonetic Symbol** | **Example** | **Meaning** |
|---|---|---|
| /a/ | m**a**ssa | Dough |
| /ɐ/ | p**a**ra | For |
| /ɛ/ | b**e**lo | Beautiful |
| /e/ | c**e**do | Early |
| /ɔ/ | m**o**lha | Dampen |
| /o/ | p**o**lvo | Octopus |
| /i/ | f**i**no | Fine |
| /u/ | fr**u**ta | Fruit |

In an acoustic vowel study, Escudero and Boersma (2009) examined seven EuPt stressed vowels /i/, /e/, /ɛ/, /a/, /ɔ/, /o/and /u/, excluding /ɐ/ from Table 2.9. The average vowel duration, F0, F1 and F2 for female speakers of EP is presented in Table 2.10.

Table 2.10: Average Vowel Duration, F0, F1 and F2 for Female Speakers of EP (Reproduced from Escudero and Boersma, 2009, p. 8)

| Vowel | i | e | ɛ | a | ɔ | o | u |
|---|---|---|---|---|---|---|---|
| Duration (ms) | 92 | 106 | 115 | 122 | 118 | 110 | 94 |
| F0 (Hz) | 216 | 211 | 205 | 202 | 204 | 211 | 222 |
| F1 (Hz) | 313 | 402 | 511 | 781 | 592 | 422 | 335 |
| F2 (Hz) | 2760 | 2508 | 2360 | 1662 | 1118 | 921 | 862 |

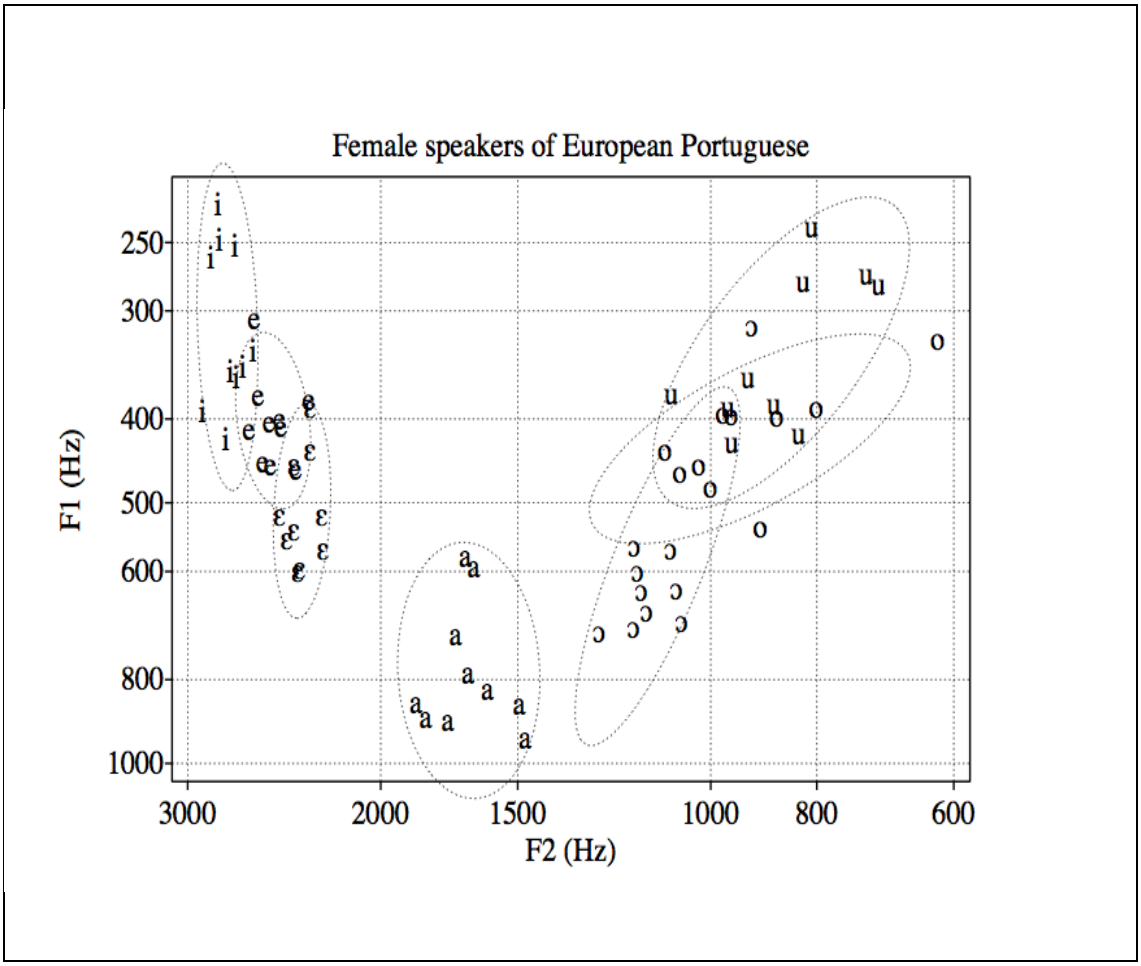


Figure 2.4: Europen Portuguese Vowels

(Reproduced from Escudero & Boersma, 2009, p. 8)

Although MPC may share similar vowels with Malay, MalE and EuPt, the quality of these vowels may be different, especially between EuPt and MPC as MPC do not tend to speak EuPt.

## 2.7 Characteristics of other Portuguese Creoles

The following sections will discuss the vowel inventories of some of the Portuguese Creoles in Africa and Asia .

### 2.7.1 The Creoles of Cabo Verde

In the creole of São Nicolau, there are sixteen vowels which can be branched into eight oral vowels and eight nasal vowels. The eight oral vowels consist of [i,], [e], [è], [u], [o], [a], [ò] and [à], whereas the eight nasal vowels consist of [in], [en], [èn], [un], [on], [an], [òn] and [àn] (Cardoso, 1989, p. 136). Cardoso has also listed out the diphthongs and triphthongs as the result of combination of two or three vowels in the São Nicolau Portuguese Creole. Compared to MPC which has a more reduced set of vowels and limited numbers of diphthongs; the São Nicolau Portuguese Creole has a large set of twenty-three distinguishable diphthongs. These diphthongs can be further divided into groups of increasing diphthongs and decreasing diphthongs. Also, this creole has four triphthongs which are normally used at the syllable ending position. Triphthongs are not found in current day MPC. Neither do they exist in SM and MalE.

Meanwhile, Lang (2002, p. xxiv) explained that the Santiago Creole in Cabo Verde has eight oral vowels [ɛ], [a], [ɔ], [ə], [ɑ], [o], [i] and [u], and five nasals. The differences between the vowels of these two creoles within Cabo Verde highlighted that the

evolution of creoles is not restricted to only one creole within a national boundary. This situation is probably also due to the fact that Portuguese language is also an official language in Cabo Verde and the amount of total speakers is huge. Unlike Portuguese Creole in Cabo Verde, MPC is restricted within a small village and does not have official language status to help the survival of this endangered creole.

### 2.7.2 Bidau, Timor Leste Portuguese Creole Vowels

In Asia, the Portuguese Creole is spoken in Timor-Leste especially in the village of Bidau (Castro, 1943, p. 56; Thomaz, 1985, p. 332). In general, the Bidau Portuguese Creole (BPC) matches the traits of two other Southeast-Asian Portuguese Creoles, which are known as Macao (Thompson, 1959) and MPC (Baxter, 1985). However, unlike MPC, the other two are co-existing with Portuguese language, where Portuguese is the official language and where there are still Portuguese-medium schools.

Baxter (1990b, p. 7) says that BPC, MPC, Macao and Tugu Portuguese Creoles share similar traits of nasalised vowel in the Vowel + /ŋ/ combination. For example, *teng* /teŋ/ 'have' and *bong* /boŋ/ 'good'. However, BPC has a distinct Portuguese palatal fricative feature which sets it apart from MPC, MMC and Tugu Portuguese Creole. The reflex of Portuguese /ʎ/, for example *mulher* 'woman' is now being spoken as the sound between [j] and [dʒ], as [y] /muyer/ in BPC. On the contrary, the other three creoles all pronounce it as /l/ (Baxter, 1987).

### 2.7.3 Macao Maquista Creole

Macao Maquista Creole (MMC) is said to originate from MPC due to its geographical proximity (Baxter, 1996, p. 323) after some Portuguese left Malacca for Macau in the sixteenth century. Portuguese navigators commenced their permanent occupation in Macau in 1557 (Nunes, 2011, p. 167) attracting more people who were based at Portuguese communities like Goa and Malacca. When the Dutch occupied Malacca from 1641 onwards, even more Portuguese descents from Malacca went to Macau. The MPC spoken at that time already had local influence such as Malay. Hence, features of MPC and Malay are introduced to Macau and influenced the foundation of MMC. Such influence can be noticed from Malay elements in MMC such as in Batalha's (1988) glossary which found that 17% of the items originated from Malay. These features from MPC are said to have set the root of MMC and though there is a difference of about 50 years from when the Portuguese arrived in Macau, both creoles remain very similar in terms of phonology, grammatical and lexical structures. Nunes (2010, p. 172) also pointed out influence from MPC in MMC showing similar usage of the perfective marker ja + Verb in both MMC and MPC to indicate actions which have 'already been performed' whereby this feature is said to be influenced by the contact from its substrate MPC.

Fernandes and Baxter (2004) describe MMC as comprising eleven vowels, which are [ẹ], [ę], [e], [a], [ạ], [a], [ą], [o], [ọ], [ǫ] and [u] which can appear in both stressed and unstressed environments. For an environment such as Macau where there is co-existence of current day European Portuguese speakers, the vowels show minimal reduction and maintain most features from the modern Portuguese pronunciation while also showing influences from Cantonese, which is another widely used language in

Macau. It is noticeable in MMC that the /a/, /e/ and /o/ vowels are unstable for it varies with different level of openness from one speaker to another, with no predictable patterns across speakers (Batalha, 1950; Fernandes and Baxter, 2004). By observing that there is little difference between work done in the fifties (Batalha, 1950) and more recent work (e.g. Baxter and Fernandes, 2004), it appears that MMC has not gone through drastic changes in relation to its vowels. This situation could be due to influence from Portuguese via Portuguese-medium schools and continuous contact with EuPt in Macau unlike the situation in Malacca.

## 2.8 Formant Frequency of Vowels

In acoustic studies, formants are the defined as "spectral peaks of sound spectrum" (Fant, 1960, p. 106), where each acoustic signal correlates with distinguishable shapes of human vocal tract forming different vocal resonance. These produced sounds are phonetically labeled as various phonetic sounds according to its vowel quality and characteristics (Fant, 1981). Benade (1976) also defined formants similarly as "the peaks that are observed in the spectrum envelope". Formants are measured in Hertz unit. The formant frequencies are visible as the horizontally marked black lines which are layered on top of one and another within the duration of vowels in spectrogram. Usually only F1 and F2 are required to study the vowel qualities, as these values of F1 and F2 will indicate the position, i.e. frontness and height of vowels in the vowel chart (Fry, 1979; Hayward, 2000). The formants can be digitally tracked by formant-based speech production and Linear Predictive Coding (LPC) (Harrington, 2010). As portrayed in Figure 2.5, the F1 frequency value is inversely related to vowel height or open-close dimension. Meanwhile, the F2 frequency shows the tongue retraction of the

vowel, ie. fronter position when F2 value increases (Ladefoged, 2006, p. 188; Fry, 1979; Kent and Read, 2002).

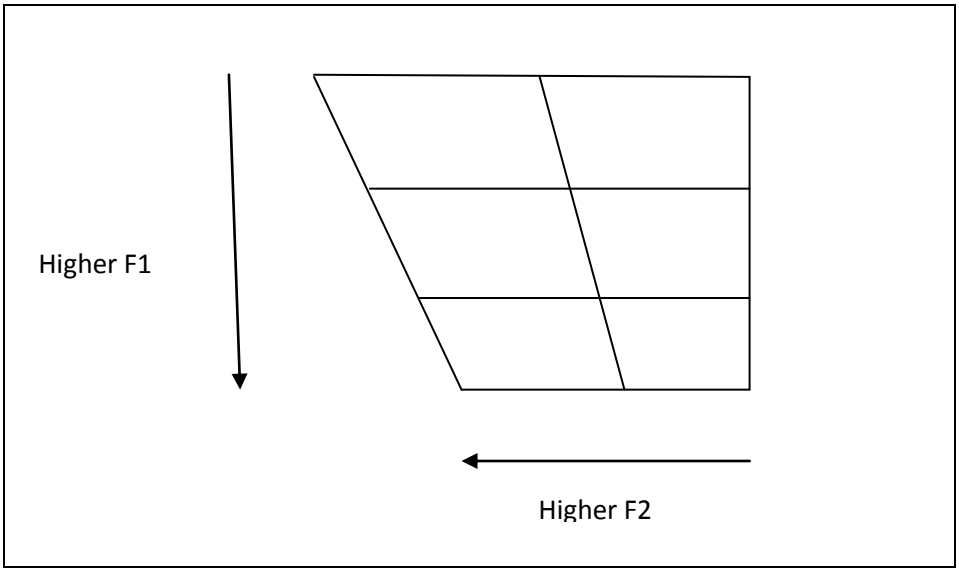


Figure 2.5: F1 and F2 values of Vowels in a Vowel Chart

(Adapted from Ladefoged, 2001, p. 116)

Watt and Tillotson (2001) and Deterding (1997) are of the opinion that a simple F1 versus F2 plot provides a sufficient representation of vowel qualities despite its known issues with representing back vowels (Hayward, 2000). Whilst some researchers prefer the F1 versus F2-F1 plot, Hayward (2000), points out that this plot has issues when it comes to the placement of central vowels. Deterding (1997, p. 51) chooses to use a F1 versus F2 plot as he maintains rightly "that the best way to represent vowel quality is not certain". Deterding (1997, p. 51) also cautions that "there is not necessarily an absolute link between vowel openness and F1 or between vowel frontness and F2".

Meanwhile, Zwicker and Terhadt (1980) proposed to convert the F1 and F2 values from Hertz unit to Bark unit for chart plotting purposes, with the formula as follow:

$$Z = 13 \arctan(0.00076F) + 3.5 \arctan(F/7500)^2$$

(Reproduced from Zwicker and Terhadt (1980))

Kent and Read (2002, p. 115) supported that "it is thought to be a good approximation of the actual frequency analysis performed by the ear". Hayward (2000, p. 152) too is in the opinion that a Bark scale converted vowel chart would present more "psychologically real" picture of the vowels, as opposed to the Hertz scale which would not be able to portray the said close-to-real-life features.

## 2.9 Euclidean Distance

Euclidean Distance (ED) is used as a guide to represent vowel space by measuring its distance from the center of the vowel space (Harrington, 2010). The higher ED values indicate a more peripheral vowel space, i.e. more spread out arrangement of vowel inventory. Harrington (2010, p. 191) also added that ED formula could be applied to provide information of the vowel space closeness in sound change studies. Deterding (1997, p. 50) and Harrington (2010) explain the measurement method beginning from the centroid, known as the centre of vowel space, which can be obtained by the ED formula as follows. The average F1 and F2 values in Hertz unit are firstly converted to a Bark unit prior to the ED calculation.

$$ED = SQRT(((F1AVE-F1)^2) + ((F2AVE-F2))^2)$$

(Reproduced from Harington (2010, p. 191))

SQRT = Square Roots
* F1 and F2 values are in Bark unit

## 2.10 MPC Orthography

Rêgo (1942) was one of the first missionaries who produced written materials using the modern day Portuguese-based system. This written system was composed under the misconception of treating MPC as one of the dialectal varieties of Portuguese, rather than being recognized by its Creole status (Baxter, 2004, p. x). The notion by other missionaries that MPC is "a sort of broken Portuguese" (Cameron, 1865, p. 375) or "a dialect which has lost its Portuguese grammar" (Pintado, 1908, p. 81) has also contributed to the negative perception of MPC since the 19th Century (Baxter, 2004, p. 42). Current day observations in the Portuguese Settlement also indicate that some speakers from Portugal who visit the Settlement also tend to validate such negative perceptions after their interactions with MPC speakers, labelling this variety as broken variety. The teaching of European Portuguese at the Settlement also does not help alleviate the status of MPC as a valid language in its own right deserving of a systematic orthographic system (Baxter, 1988).

It is evident that at present the members of the MPC speech community lack an agreement on how MPC should be written. The orthography chosen by previous researches has been a mixture of Portuguese, English, and Malay depending on their inclination. The Portuguese Settlement Committee in the nineties has occasionally spelt MPC words with the reference to Portuguese dictionaries for they felt that it should approximate its Portuguese roots and also allow easier access between the Portuguese speakers and Portuguese descendants in Malacca (Baxter, 1988). However, Baxter (1988) argues that Portuguese-based orthography is not practical due to linguistic differences between the two languages. Using a Portuguese-based orthographic system

would mean that only speakers who can read Portuguese (which are few in the settlement) will be able to understand such a system (Baxter, 2005).

Meanwhile, written texts by the Portuguese descendants tend to use a mixture of spelling systems. For example, Sta Maria's (1994) book title *Undi Nos By Di Aki?* uses the English *by* to represent /bai/ esentlish i?ing *aki* 'here' is inclined towards the Malay or English /k/ sound instead of Portuguese /q/ sound. This inconsistent spelling system possesses a challenge for wider usage of written materials in MPC. Baxter (1988, p. 42) explained that those who insisted on maintaining a Portuguese-based spelling system, were perhaps influenced by the "degree of contacts" with Portuguese missionaries at church and schools. Hancock (1973. p. 25) proposed the orthography which is much similar to the Malay system, namely 'ny' as 'ñ', 'ch' as 'c' in Malay. Hancock felt that the Malay-based system was an advantage as that the speech community already understands Malay and it is phonologically identical to MPC. Malay orthography appears to be a simpler system compared to Portuguese and would be understood by non-Malay or MPC speakers. A Malay-based orthography approach is also supported by Baxter (2004, p. xii) and Marbeck (1995) in their publications. A survey of social media also indicates a preference for such a spelling system by the younger generations of MPC users despite some quarters still insisting on a Portuguese-based orthography.

## 2.11 Conclusion

This chapter discussed the characteristics of MPC vowels from previous studies. In order to enable comparisons with local languages and Portuguese, the characteristics of Malay, Malaysian English and European Portuguese vowels were also discussed, as

were some of vowels in some Portuguese Creoles in Asia and Africa. This chapter also discussed how vowels are acoustically analysed using the formant frequency model, together with explanations on the application of mathematical formulas for various calculations. The following chapter will present the methodology in the present study.

# CHAPTER 3

# RESEARCH METHODOLOGY

## 3.1 Introduction

This chapter highlights the methods used for data selection, data collection and data analysis. The first section covers the selection of the language consultants (LCs), followed by the type of data collected in this study. The third section describes how the data were collected and organised, and in the final section the procedures for data analysis is explained.

## 3.2 Language Consultants

In studies on endangered languages and their community, it is inevitable that only a limited number of LCs were accessible for research data collection. As Creswell (2009, p. 147) raised the importance of paying attention to its sampling design, a probability sampling method with known probability of respondents selection (Kalton, 1983) was chosen to be applied in current study. The non-probability sampling method (Kalton, 1983) is not suitable for endangered language research because random selection will most likely pick up respondents who rarely speak MPC causing skewed results. There are very few fluent speakers because most of the younger generations of such endangered language community are greatly exposed to other languages which have more educational or economic value. The Malay-medium education system at schools, the domestic language policy coupled with the economic value of English tend to place a low value on MPC for future prospects among younger generations of Portuguese

Eurasians. Hence, less fluent MPC speakers can be found among the generations of youth and below. Previous studies (David & Faridah Noor Mohd Noor, 1999; Lee, 2003, 2004; Sudesh, 2000) on MPC and its community have indicated that younger speakers are not fluent in MPC. Thus, the remaining speakers of endangered languages often consist of those from a senior age group. At an older age, speakers might experience teeth loss, have a weak hearing ability, exhibit poor vocal quality due to long term habits or old age, or be simply physically unfit due to illnesses. Their physical condition may impede speech clarity especially in phonetic studies. In the Portuguese Settlement where this study is based, LCs among the age group above the age of 60 years old are more likely to be more fluent in MPC, which is an important factor in this study.

As proposed by Creswell (2009, p. 145) the target population sampling approach was applied in this study to choose only speakers who meet the pre-set selection requisitions (see the next section). Though a study consisting of only five subjects for a research may be considered small for most quantitative and qualitative research, this is not unusual in phonetic studies (e.g. Harrington, 2010). Further, the Portuguese Settlement in Malacca is a small community with the estimated population of less than 1,000 (Lee, 2004) comprising 115 homes (Baxter, 2005). The five subjects comprise almost 0.5% of the entire settlement population.

The five female MPC LCs were selected based on the following criteria: (i) gender (female speakers), (ii) age (60 and above age group), (iii) ethnicity defined by them being Portuguese Eurasian descendants who grew up and are still living in the Portuguese Settlement), (iv) their mother tongue (Malacca Portuguese Creole), (v)

language use (they use predominantly MPC to communicate with fellow Portuguese Eurasians in the Settlement). The selected LCs have an age range of from 69-80 years, with a mean of age 73 years at the time of recording. All LCs could communicate without physical hindrance related to their senior age, i.e. had no reported speech or hearing impediments.

The identity of these LCs was preliminarily determined based on the duration they have been living in the Portuguese Settlement. From preliminary interviews with them, all LCs indicated that they were born or grew up in the settlement since early childhood. All LCs have Portuguese surnames. These LCs all introduced themselves as 'Portuguese', '*Serani*' or 'Eurasian'.

This research has selected only female LCs to keep the gender variable constant. Initially it was due to the consideration on how positive their participation was during the speech recordings. During the early stage, it was noticed that female speakers were more outspoken and willing to share their thoughts and personal experiences with researchers, as compared to the male speakers of similar age group. The male speakers were less likely to speak on contents related to their personal life experiences. Furthermore, women tend to put in effort to speak clearly (Byrd, 1992; Whiteside, 1996) with higher resonance frequencies (Foulkes & Docherty, 1999; Simpson, 2009; Wang & van Heuven, 2006; Yusuf, 2013). Throughout the interaction with potential respondents, the researcher noticed that women are more prone to share information about their life, culture and domestic related topics. The coverage of topics in female respondents' interviews are broader compared to the interviews with male respondents. Also, Maragakis (2008) raised the fact that the male vocal tract is longer than the female

vocal tract, causing different levels of resonance frequencies. Thus, as Deterdings points out by deciding on only one gender criteria in acoustic studies, the vocal tract difference between male and female is considered and this can ensure better uniformity in the analysis and comparison among equally high pitch female voices.

None of the LCs has learnt the current day European Portuguese formally or informally. These speakers also did not have much contact with the Portuguese speakers from Europe. It is observed that in the Portuguese Settlement, the women seldom spend their leisure time mingling with the foreign visitors or tourists in the public settlement square of the Portuguese Settlement. All five LCs also do not work or have business in the settlement, which means they have been staying at home and having less contact with the outsiders who visit the Portuguese Settlement. It can be assumed that these LCs being housewives they would also have less contact with the other language speakers from the surrounding living environment. On the contrary, men being the wage earner of the family work outside, having more external contact with the outsiders, causing them to possibly pick up some modern day Portuguese vocabulary and those from other languages through external interaction with tourists and visitors to the Portuguese Settlement .

Despite having mentioned their underprivileged childhood and limited years of education, these LCs all have attended at least primary school. These ladies aged 60 and above would fall into the category of those who have undergone an English medium education system from the 1940‘s until January 1970. The mixed Malay-English-medium transition took place during the 1970’s (Tan, 2005). English-medium schools were completely phased out by 1982 and replaced by the Malay-medium national

school system at the secondary school level. Hence, these LCs above 60 are among those who attended English-medium schools and used English in schools compared to the younger age groups in the Settlement who went through a fully Malay-medium education system from 1982 onwards.

The selected LCs are all mother tongue speakers of MPC. They were born in families who spoke MPC and used it dominantly in their domestic events and with the fellow elderly Portuguese Eurasians who also spoke MPC during their daily life spent in the Portuguese Settlement. The LCs are Portuguese descendants who were born or moved into the settlement with their parents when they were young.

These five LCs live in the Portuguese Settlement on different streets scattered over the entire area. This is to allow better coverage of MPC speakers from different families and various areas in the settlement. The Portuguese Settlement (see Figure 3.1) was chosen for the study because it is the only area in Malaysia where there is a concentration of MPC speakers, and indeed its existence has been attributed to the present survival of the language (Baxter, 2005).

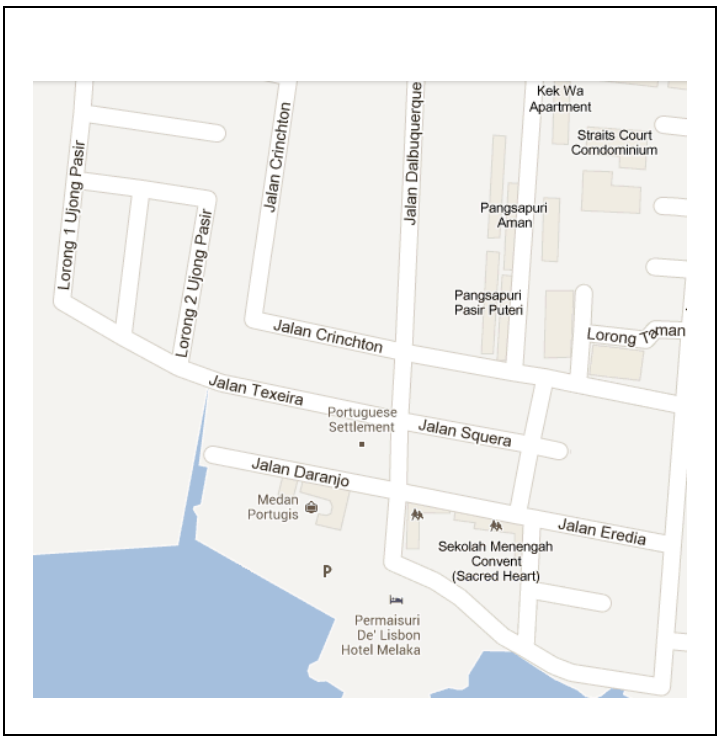


Figure 3.1: Map of the Malacca Portuguese Settlement

(Reproduced from Google Map Malaysia - https://maps.google.com.my/)

In this study, the LCs are coded as LC1 through LC5. All five of them gave written consents to participate in this study. Their demographic details are displayed in Table 3.1.

Table 3.1: Demographic Background of MPC LCs

| LC | Age | Occupation | Spoken Language | | | | | Education Background and Medium of Instruction in Schools | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | MPC | MalE | SM | Chinese and other Dialects | Tamil or other Indian languages | Primary Education | Secondary Education | Tertiary Education |
| 1 | 75 | Housewife | yes | yes | yes | no | no | English | English | NA |
| 2 | 72 | Housewife | yes | yes | yes | no | no | NA | NA | NA |
| 3 | 80 | Housewife | yes | yes | yes | no | no | English | English | NA |
| 4 | 69 | Housewife | yes | yes | yes | no | no | English | NA | NA |
| 5 | 71 | Housewife | yes | yes | yes | no | no | English | NA | NA |

## 3.3 Data Collection Procedure

As the researcher for this study is not member of the speech community and is often seen as intruder to the target community, the selection of LCs was challenging. During the initial stage of observation on the community, few members of different families in the Portuguese Settlement were apporached. By getting to know several members in a family, it was easier to expand the connection to their relatives. This approach ensured speakers' comfort in interacting with the researchers. Through introduction from one family to another, e connections can be forged and bigger network formed as inviations to participate in community-based festivals and events are given. The daily activity patterns of various age groups were also observed in order to determine the possibility to arrange for interview and recording sessions with particular groups of speakers. The researcher is indeed seen as intruder in the lives and time of the

community members. Hence, extra planning and consideration are crucial as to not offend the feelings or to not interfere with the community members' usual lifestyles.

### 3.3.1 Speaking Context

The recorded data comprised of interviews with LCs on topics related to their life in the Malacca Portuguese Settlement. For acoustic analysis, various methods of data collection have been implemented in studies on different languages. Word lists (Tsukada, 2008; Yusuf, 2013), embedded target words in a carrier sentence (Lee & Lim, 2000; Pillai, Zuraidah, Knowles & Tang, 2010), spontaneous speeches elicited through structured interviews (Deterding, 2000; Chan & Pillai, 2012) and flashcards triggered sources (Walters, 2006; Chan & Pillai, 2012) are commonly used. However, unlike other studies (e.g. Pillai & Yusuf, 2012; or Milroy, Milroy, Docherty, Foulkes and Walshaw, 1999), a word-list or read text was not used in this study because it aims at recording the natural speech in order to capture the current sounds of MPC. In natural speech it is believed that the LCs who have a tendency to feel inferior towards their MPC pronunciation, will produce more natural speech sounds.

The LCs were not asked to read the target words from a reading list because MPC is used as a spoken language rather than a written language. The wordlist or reading list method could not be applied in this study due to the MPC's condition as a non-written and endangered Creole. The MPC does not have its standard written system and the MPC have been presented with various orthographical systems in the previous studies. The previous studies have compiled the written materials with a mix of Portuguese, English and Malay orthographic systems (see 2.10). Though written texts were not used

to elicit data, a Malay-based orthography is used for the presentation of MPC words in this study, which is also supported by Baxter (2004, p. xii) and Marbeck (1995) (see Chapter 2.10).

During an early stage of the study, it was observed that the Portuguese community members who speak fluent MPC could not fluently read out the written texts of poems collections or the lyrics of traditional MPC songs. Hence one might not be able to naturally pronounce the target words from the provided reading list. The unfamiliarity of LCs towards the orthography system will definitely hinder this study from obtaining a more accurate and natural recording result of the acoustic production of MPC vowels.

The subjects were interviewed about their daily lifestyles, domestic language policy, culture, opinions towards the future of MPC for approximately 10 minutes each to elicit vowels produced in spontaneous speeches. A semi-structured interview was used to collect data in this study (see APPENDIX A for interview questions). The interview questions were based on four areas: self-introduction, education background, domestic language policy or within the settlement, and perceptions about MPC and its culture. The semi-structured interviews were conducted in such a way that the LCs were prompted to answer by being asked questions in MPC to encourage them to speak naturally in a more comfortable speaking environment. For example, simple and direct self-introduction questions (e.g. *Ki bosa nomi?* 'What is your name?' and *Bos kantu idadi?* 'How old are you?') helped LCs to share their thoughts spontaneously. When interacting with the researcher who is an outsider, the MPC speakers often shy themselves away for the fear of being labelled as speaking a 'less perfect' version of MPC. The use of MPC by the researcher helped the LCs to be more relaxed.

Considering the general interests of these LCs who were homemakers which mostly revolve around their family and food preparation, questions about their family members and traditional Portuguese food preparation procedures encouraged them to open up during the interviews.

The disadvantage of extracting vowels from a spontaneous speech method is that the collected vowels might not be complete. The vowels in connected speech are also prone to be affected by prosodic features like intonation and stress. Jacobi (2009) and Harrington (2010) both mentioned that the unintended reduced vowels are often extracted in spontaneous speech, which is something to be wary off. Further, the vowel inventory is predicted to be less peripheral in spontaneous speeches as speakers would be less cautious in trying to pronounce 'slowly and accurately'.

### 3.3.2 Instrumentation

Recordings of the speakers were carried out in the homes of LCs using head worn microphones and a high quality 16-bit rate digital professional recorder, the Marantz PMD661 Solid State Sound Recorder. The recordings were sampled at 44.1kHz. The head-worn microphone was positioned closely to the mouth of LCs to minimise the external noise sounds and increase recording clarity.

## 3.4 Data Transcription and Selection

The data obtained from the recordings were orthographically transcribed and annotated into Praat 5.2.04 (Boersma & Weenik, 2010). The transcription was done by a native

speaker of MPC to ensure better understanding of the recorded speeches and higher accuracy on the transcription. Again, as mentioned in 3.3.1, the transcriptions were done with Malay-based orthography. Using the TextGrid function in Praat, the MPC transcriptions were entered into the first tier.

From the transcribed recordings, a total of six MPC vowels were identified and were selected for analysis based on descriptions by previous studies (see 2.4). The target vowels were selected from environments without neighbouring nasals, liquids or approximants. It is possible that the final result of this study might not present a complete understanding of MPC vowels because of these restrictions but this was done to reduce co-articulatory influences on the vowels. Vowels in both open and CVC syllables were extracted for analysis. In view of the natural speech data and the criteria for vowel environment in this study, the number of vowels selected for analysis does not reflect the total number of vowels produced.

## 3.5 Measurements and Analysis

The decision to use an acoustic methodology in this study was to supplement the existing impressionistic descriptions of the sounds of MPC. Visual inspection of the spectrograms in Praat and auditory inspection of the recorded speech were combined to determine and measure the first formant (F1) and second formant (F2) and duration of the target vowels of the words selected for analysis and the measurements were entered in the tiers following the orthographic transcriptions of MPC.

The F1 and F2 were identified manually on spectrograms of the target vowels. Then using the automatic linear predictive coding (LPC) function in Praat the F1 and F2 were measured from the central point of each targeted vowel. The central point of each targeted vowel was used as it is anticipated that at this point, the vowel quality would be the most stable and display less co-articulatory effects from neighbouring sounds (Fry, 1979; Hayward, 2000; Watt and Tillotson, 2001; Ladefoged, 2003; Pillai & Yusuf, 2012).

Time-aligned transcriptions and annotations were entered using the TextGrid function of Praat. Tier 1 contains transcriptions in the form of MPC phrases. In Tier 2, the words selected for the analysis of MPC vowels were entered. In the third interval tier, the targeted vowels were segmented. Tier 4 and Tier 5 are labelled as F1 and F2 respectively, and lastly, Tier 6 indicates the time position where every targeted vowel is located from the original speech recording, to allow easy reference of the targeted vowels, if verification of measurement is required. A Praat script was run to measure the durations of the selected vowels and the results generated in a text file was transferred to an Excel file (Lennes, 2002).

Figure 3.2 displays the transcriptions and annotations inserted into the tiers of targeted /e/ vowel produced by LC1. All information was manually entered into the six-tiered-TextGrid for all the five language consultants, applying the same tier layout. Next, the obtained values from Tier 3, Tier 4, Tier 5 and Tier 6 were entered in a spread sheet to enable further calculation of average of values and generate vowel charts in Excel to allow plotting of scatter plots for comparisons among MPC vowels and analysis across LCs.

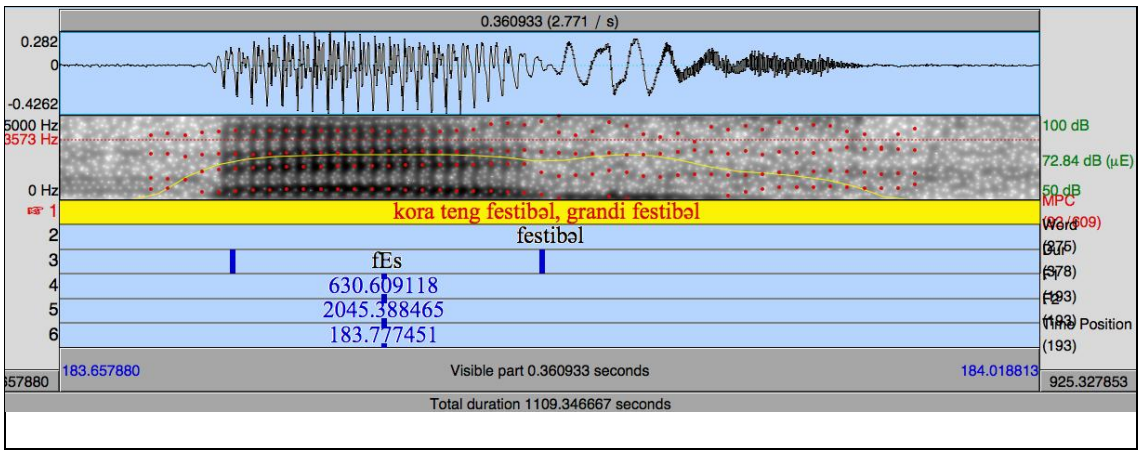


Figure 3.2: TextGrid of MPC /e/ from the word *festibel* by LC1 saying '*kora teng festibel, grandi festibel*'

These values were later converted into a Bark scale (Zwicker & Terhadt, 1980,p. 1524) using the following formula:

$$Z = 13 \arctan(0.00076F) + 3.5 \arctan(F/7500)^2$$

(Reproduced from Zwicker and Terhadt (1980))

The measurements of each monophthong token in Hertz and their Bark values are listed in APPENDIX B1 to APPENDIX B6. The list of words from which each MPC vowel was extracted and its translation is presented in APPENDIX C1 to APPENDIX C6.

The average values from the complete set of targeted vowels were plotted into F1 vs F2 vowel charts (Deterding, 1997; Hayward, 2000) (see 2.8). Scatter plots were plotted to compare the following: vowels in different syllable combinations (e.g. CV, CVC or CCV); vowels produced by different LCs; and the height of vowel in the following

syllable. Comparisons with the two local languages spoken by the LCs, Malay and Malaysian English, and with European Portuguese were also performed to examine how close in vowel quality equivalent vowels were produced. The Euclidean Distances of the vowels from these languages as well as MPC were calculated (see 2.9). ED indicates pictorial hints of the extent of which vowel inventory of a language is peripheral. Though it is possible to compare how each set of vowel inventory of MPC, Malay, MalE, and EuPt differ from each other solely based on the scatter plot of F1-F2. The obtained ED values could further investigate how spread out are the monophthong vowels from a language. Since ED is measured from the center vowel as controid, the centre vowel such as /ə/ and English /ɜ/ is excluded.

Table 3.2 displays the number of monophthong tokens selected from the interview data of five Language Consultants. As mentioned previously in this Chapter, the vowels were selected for analysis based on particular criteria (see 3.4). This yielded a total of 1083 tokens which were analysed in this study.

Table 3.2: Number of MPC Vowel Tokens extracted from Recordings

| MPC Vowels | Number of selected tokens | | | | | |
|---|---|---|---|---|---|---|
| | LC 1 | LC 2 | LC 3 | LC 4 | LC 5 | |
| /i/ | 23 | 12 | 13 | 46 | 29 | 123 |
| /e/ | 32 | 13 | 20 | 64 | 53 | 182 |
| /ə/ | 10 | 8 | 3 | 20 | 22 | 63 |
| /a/ | 44 | 43 | 58 | 169 | 180 | 494 |
| /u/ | 36 | 19 | 2 | 33 | 24 | 114 |
| /o/ | 7 | 12 | 21 | 28 | 39 | 107 |
| **TOTAL** | | | | | | **1083** |

The number of target vowels differs due to the occurrence in the recordings and also the selection criteria in this study. Some MPC vowels which fulfill the selection criteria occur more frequently while other vowels were omitted from the selection due to their neighbouring nasals and approximants. The vowel /a/ occurred most frequently in the selected data, followed by /e/. The /ə/ occurred often at the CV open syllable vocabularies and very often it was followed by nasals or approximants, or was at the end of phrases with no succeeding consonants. Such instances of words were not selected for analysis unless the next word following *atape* begins with a consonant. Hence, explaining the few instances of /ə/ from the selected data.

### 3.6 Statistical Analysis

Besides discussion of the characteristics of MPC vowels based on the F1 and F2 values, statistical analysis such as ANOVA and T-test were carried out where appropriate.

Independent ANOVA tests were applied onto a group of three to five variables (e.g. comparisons of formant values of MPC vowel among five LCs). For ANOVA, when significant differences among groups were found, a Tukey post-hoc test was conducted to further investigate the significant differences (or not) between any pair of within the group.

## 3.7 Conclusion

This chapter explained the procedures and methodology applied in this study. The following chapter presents data analysis and discusses the findings on MPC vowels from the obtained results.

# CHAPTER 4

# FINDINGS AND DISCUSSION

## 4.1 Introduction

This chapter discusses the findings obtained from this study. Findings for each MPC vowel and comparisons among the five LCs, in different syllable combinations and different word positions are presented and discussed in this chapter. Reference to the Malay language, Malaysian English and European Portuguese are also made where relevant.

## 4.2 MPC Monophthongs

The average measurements for F1 and F2 in Hertz and Bark, Standard Deviation (SD), and average vowel duration are presented in Table 4.1. The Euclidean Distance (ED), measured from the centre of the vowel space, is also presented (see 3.5). The measurements for each of the vowels extracted for this study are presented in APPENDIX C1 to APPENDIX C6. As discussed in Chapter 3, only vowels which fulfilled the criteria mentioned were extracted for analysis (see 3.4).

Table 4.1: Average Values for F1 and F2, Standard Deviations, Average Durations and Euclidean Distance of MPC Monophthongs

| Vowel | Ave. Duration and SD (ms) | Ave. F1 and SD (Hertz) | Ave. F2 and SD (Hertz) | Ave. F1 (Bark) | Ave. F2 (Bark) | ED (Bark) |
|---|---|---|---|---|---|---|
| /ɪ/ | 90.42 (70.13) | 451.23 (77.98) | 2201.30 (436.42) | 4.30 (0.68) | 13.54 (1.43) | 1.80 |
| /e/ | 129.12 (0.09) | 507.08 (72.21) | 2251.68 (389.81) | 4.79 (0.61) | 13.72 (1.33) | 1.82 |
| /ə/* | 103.50 (108.31) | 551.15 (76.27) | 1723.43 (349.55) | 5.16 (0.64) | 11.98 (1.38) | * |
| /a/ | 87.59 (63.66) | 721.96 (135.14) | 1598.11 (243.42) | 6.51 (1.03) | 11.54 (1.05) | 1.47 |
| /ʊ/ | 78.08 (49.35) | 460.55 (61.70) | 1553.10 (319.25) | 4.39 (0.54) | 11.28 (1.42) | 0.96 |
| /ɔ/ | 103.34 (65.64) | 580.37 (85.45) | 1178.28 (252.04) | 5.40 (0.71) | 9.46 (1.35) | 2.46 |
| Average | | 545.39 (84.79) | 1750.98 (331.75) | 5.09 (0.70) | 11.92 (1.33) | 1.70 |

SD = Standard Deviation
ED = Euclidean Distance
Ave. = Average
ms = millisecond
*SD values are listed in parenthesis.
*The ED of the central vowel /ə/ is not measured.

Figure 4.1 shows the vowel quadrilateral for MPC monophthongs. Based on the findings, six monophthong vowels were detected. The placements are almost consistent with Klein (2006) and Baxter (1988) except for the absence of /o/ and /ɛ/ (see 2.5). The main difference between the vowels found in this study and the previous ones lies in the placement of the back vowels, with /u/ being relatively more fronted in this study, whereas Baxter presented /u/ as a high back vowels (see 2.5). The vowel /o/ is also presented as a high back vowel by Klein (2006) and Baxter (1988) (see 2.5). However, based on the measurements, there were no instances of /o/. Instead there was a low back /ɔ/ which was produced in words like *gostah* 'like to', *botah* 'put', *mpodi* 'cannot', *angkoza* 'those things', and *bos* 'you'. Henceforth, the representation of the low back /ɔ/ will be seen in this paper, substituting /o/ in Klein (2006) and Baxter (1988).

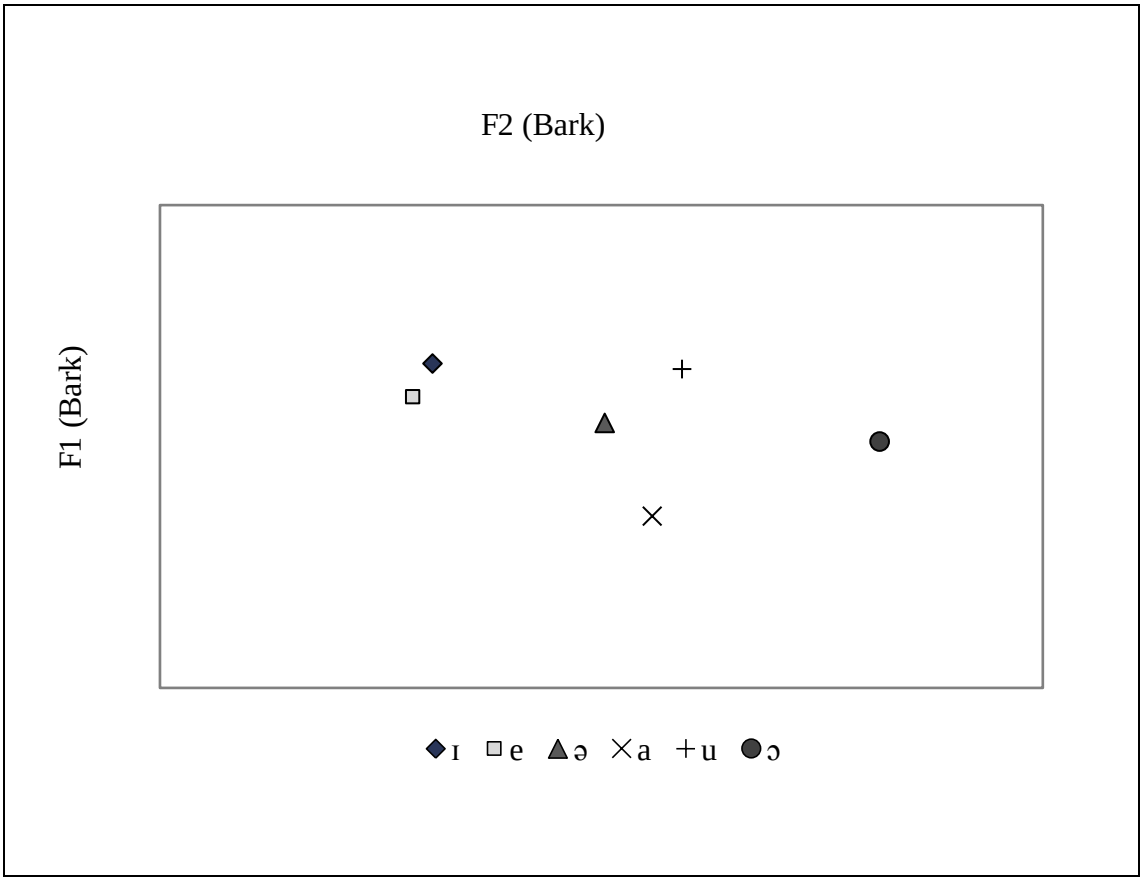

Figure 4.1: Vowel Chart for MPC Monophthong Vowels

### 4.2.1 MPC / ɪ /

The MPC monophthong / ɪ / was extracted from words such as ***f****i****k****ah*** ‘stay’, ***ak****i****h*** ‘here’, ***kuk****i****s*** ‘cookies, ***jinj****i****bri*** ‘ginger’ ***d****i****s****novi*** ‘nineteen’ (see APPENDIX B1). As can be seen in Figure 4.2 the distribution for / ɪ / is scattered in the vowel space, suggesting considerable variation in the way that it is produced by each LC (see Table 4.2) and across the five LCs. The great variation of min and max values for each LC suggests that there is speaker variation within each LC. This further indicated the unstable form of MPC where different LCs produce the same sounds with great level of variation, in a way that pronunciation patterns leading to such variation were not observed. From Figure 4.2 it can be seen that LC4 produced a more fronted / ɪ /. Meanwhile, the rest of Language Consultants (LCs) produced / ɪ / further back.

Table 4.2: Formant Measurements for MPC Vowel / ɪ /

| LC | Ave. F1 and SD (Hz) | Minimum (above) and Maximum (below) F1 (Hz) | Ave. F2 and SD (Hz) | Minimum (above) and Maximum (below) F2 (Hz) |
|---|---|---|---|---|
| 1 | 400.69 (49.34) | 276.95<br>490.63 | 2416.76 (478.67) | 1170.01<br>2844.70 |
| 2 | 363.52 (35.45) | 325.72<br>462.35 | 2024.89 (288.31) | 1618.10<br>2384.99 |
| 3 | 520.61 (85.42) | 369.71<br>689.39 | 2096.01 (450.38) | 905.55<br>2610.68 |
| 4 | 471.24 (61.59) | 374.51<br>736.27 | 2430.92 (249.03) | 1722.36<br>2777.76 |
| 5 | 464.73 (79.89) | 365.67<br>622.89 | 1786.37 (330.2) | 1286.67<br>2562.10 |

LC = Language Consultant
Ave. = Average
SD = Standard Deviation
*SD values are listed in parenthesis

A one-way ANOVA showed that there were significant differences between the F1 means of the five LCs, $F(4, 118) = 13.9$, $p < .0001$. Tukey post-hoc comparisons of the five LCs show that the F1 means were significantly different between LCs except for between LC1 (M = 400.7Hz, SD = 49.4Hz and LC2 (M = 363.4Hz, SD = 35.4Hz), LC3

(M = 520.6Hz, SD = 85.3Hz) and LC4 (M = 471.3Hz, SD = 61.6Hz), LC3 and LC5 (M = 464.7Hz, SD = 79.9Hz), LC4 and LC5. The vowel height of /ɪ/ is not clearly differentiated by LCs, as displayed in Figure 4.2.

A one-way ANOVA showed that there were significant differences between the F2 means of the five LCs, $F(4, 118) = 18.7$, $p < .0001$. Tukey post-hoc comparisons of the five LCs show that the F2 means were significantly different between the LCs except for between LC1 (M = 2416.7Hz, SD = 478.6Hz) and LC4 (M = 2431.0Hz, SD = 249.1Hz), LC2 (M = 2024.8Hz, SD = 288.3Hz) and LC3 (M = 2096.1Hz, SD = 450.3Hz), LC2 and LC5 (M = 1786.4Hz, SD = 330.1Hz), LC3 and LC5. As F2 correlates to vowel fronting, the /i/ vowels were dispersed in relation to vowel fronting, with some vowels of LC1 and LC5 being produced further back in the vowel space.

In Figure 4.2, the two outliers produced by LC1 on the top right corner are *jent**i*** 'people' and *nak**i**h* 'here'. However, the measurements were checked by another rater and no explanation for the occurrence of these two items as outliers from the data.

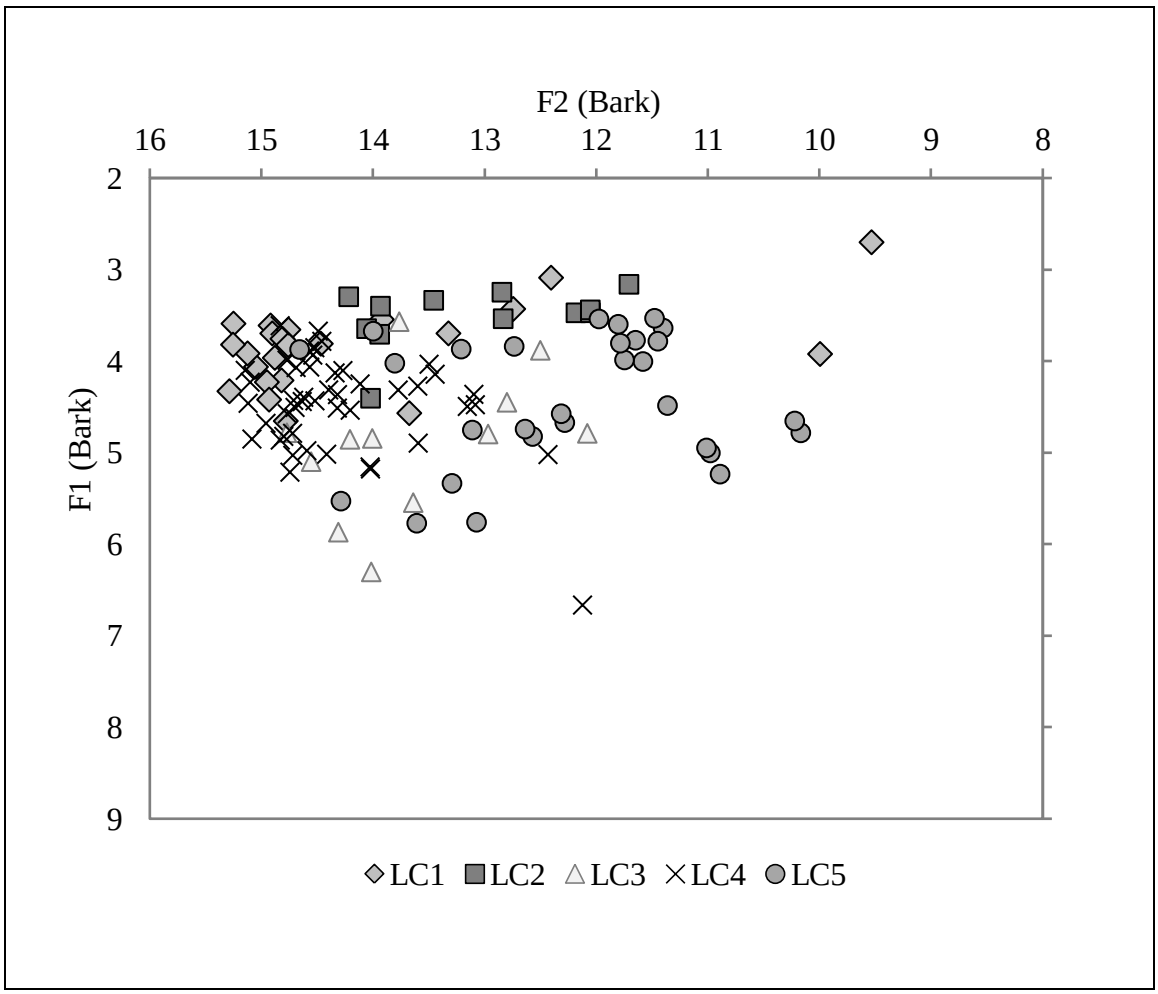


Figure 4.2: Scatter Plot for MPC /i/

Since LC5 produced most of her / ɪ / vowels centrally and further back of the vowel space, further analysis was carried out on the words produced by LC5 based on syllable position. There were no instances of CVC syllable words for / ɪ / produced by LC5 (See APPENDIX C1). When categorizing MPC words by its syllable type, it has to be kept in mind that MPC words often contain a silent orthographical 'h' at the end of words. As the 'h' is not pronounced, the final syllables in the words *nakih, ubih fizih* are CV because their IPA transcription would be /naki/, /ubi/, and /fizi/. There are twenty-eight / ɪ / CV syllable words in the scatter plot in Figure 4.3, while the only occurrence of / ɪ / in CCV syllable in the word ***ski**seh* 'forget' was located at the right lower corner. The CV syllable /i/ vowel produced by LC5 are taken from words such as ***fi**kah* 'stay', *nak**i**h* 'here', *d**i**ses* 'sixteen', *s**i**brisu* 'work', *k**i*** 'what', *ub**i**h* 'listen', *kuz**i**do* 'cooking' and *but**i**ka* 'shop' (see

Table 4.3). A scatter plot of all selected /i/ vowels by LC5 was generated as shown in Figure 4.3. However, as there were less than ten occurrences of CCV syllable words from LC5's data, no statistical test was performed.

Table 4.3: List of words of CV and CCV Syllables /ɪ/ Vowels produced by LC5

| CV Syllable Words and frequencies | | | CCV Syllable Words and frequencies | | |
|---|---|---|---|---|---|
| MPC Words | | Meaning | MPC Words | | Meaning |
| (9) | *f**i**kah* | stay | (1) | *sk**i**seh* | forgot |
| (3) | *nak**i**h* | here | | | |
| (1) | *d**i**ses* | sixteen | | | |
| (5) | *s**i**brisu* | work | | | |
| (1) | *k**i*** | what | | | |
| (1) | *ub**i**h* | listen | | | |
| (1) | *kuz**i**du* | cooking | | | |
| (3) | *but**i**ka* ‘ | shop | | | |

LC = Language Consultant

The number in parenthesis indicates the frequency of the word in the selected data

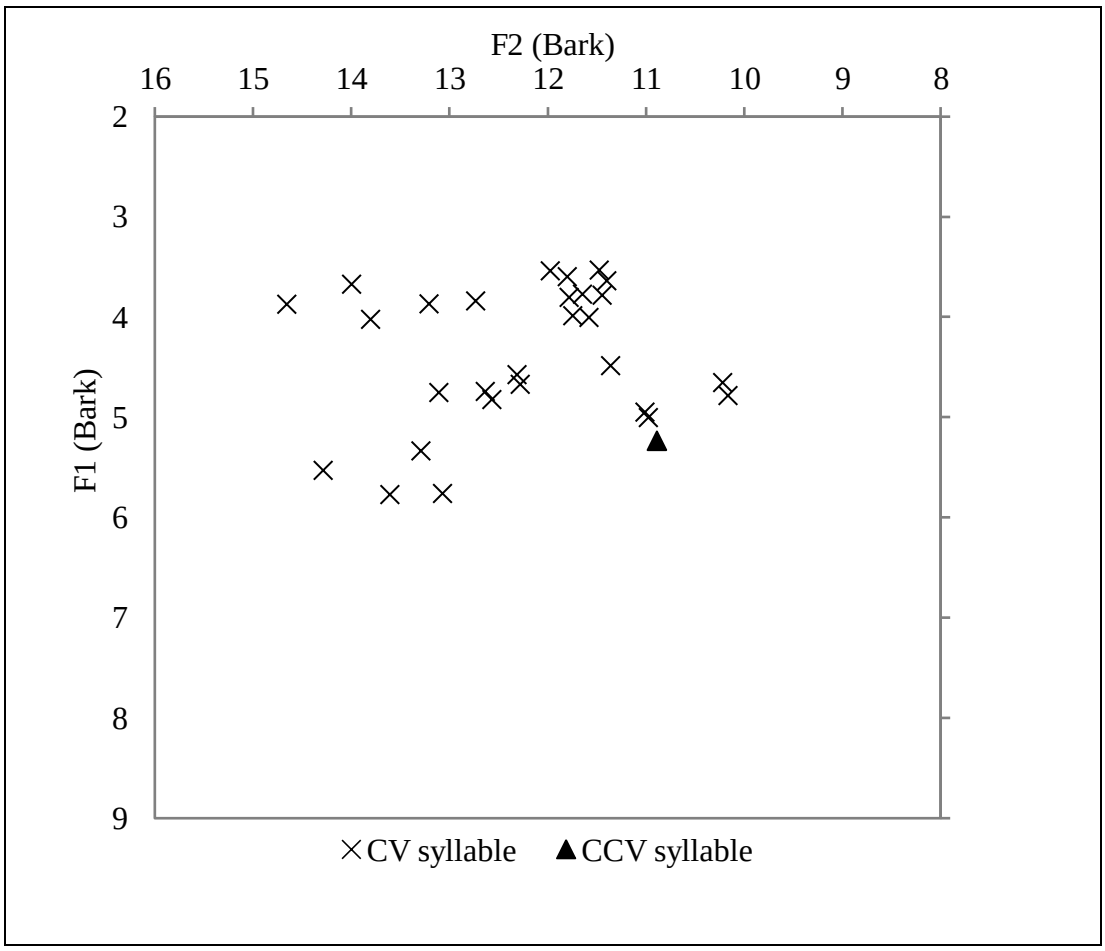

Figure 4.3: Scatter Plot of /i/ for LC5 by Syllable Position

### 4.2.2 MPC /e/

The MPC monophthong /e/ were extracted from words such as *s**e**sta* 'sixth', *s**e**stafera* 'Friday', *mb**e**s* 'a little', *prend**e**h* 'learn', *ak**e**h* 'those', *d**e**s* 'ten', and *s**e**du* 'early' (see APPENDIX B2). Table 4.4 shows formant values produced by each LC. The great variation of min and max values for each LC suggests that there is speaker variation within each LC. For example, the mean F2 of LC5 is 1888.61Hz but the F2 min and max ranged from 627.30Hz to 2729.14Hz. This feature of individual variation is observed when LC5 produced /e/ sounds differently from one word to another word. From Figure 4.4, LC1 is seen producing /e/ at a high front position. LC4's /e/ vowels are more scattered at the high front position. LC5's /e/ vowels are spread evenly with most of them located at more back position than those produced by the other LCs.

Table 4.4: Formant Measurements for MPC Vowel /e/

| LC | Ave. F1 and SD (Hz) | Minimum (above) and Maximum (below) F1 (Hz) | Ave. F2 and SD (Hz) | Minimum (above) and Maximum (below) F2 (Hz) |
|---|---|---|---|---|
| 1 | 474.13<br>(46.04) | 394.31<br>630.61 | 2516.11<br>161.72 | 2045.39<br>2729.24 |
| 2 | 490.20<br>(88.90) | 391.24<br>635.93 | 2013.63<br>257.98 | 1501.37<br>2331.78 |
| 3 | 545.92<br>(91.92) | 419.35<br>807.12 | 2242.09<br>230.33 | 1608.94<br>2629.96 |
| 4 | 515.65<br>(68.70) | 389.16<br>685.84 | 2471.49<br>195.19 | 1992.46<br>2842.69 |
| 5 | 506.12<br>(69.63) | 397.82<br>704.86 | 1888.61<br>425.85 | 627.30<br>2729.14 |

LC = Language Consultant
Ave. = Average
SD = Standard Deviation
*SD values are listed in parenthesis.

A one-way ANOVA showed that there were significant differences between the average F1 means of the five LCs, $F(4, 177) = 3.73$, $p = 0.01$. Tukey post-hoc comparisons of the five LCs show that the F1 means were significantly different only between LC1 (M = 474.1Hz, SD = 46.0Hz) and LC3 (M = 545.9Hz, SD = 91.9Hz), LC2 (M = 490.2Hz,

SD = 88.9Hz) and LC3. Thus, in terms of vowel height, vowels are quite dispersed as can be seen in Figure 4.4.

A one-way ANOVA also showed that there were significant differences between the F2 means of the five LCs, $F(4, 177) = 39.98$, $p < .0001$. Tukey post-hoc comparisons of the five LCs show that the F2 means were significantly different between the LCs except for between LC1 (M = 2516.1Hz, SD = 161.7Hz) and LC4 (M = 2471.5Hz, SD = 195.2Hz), LC2 (M = 2013.5Hz, SD = 258.1Hz) and LC5 (M = 1888.6Hz, SD = 425.9Hz). In other words, the vowels were also dispersed in relation to vowel fronting, with some vowels being produced further back in the vowel space in Figure 4.4.

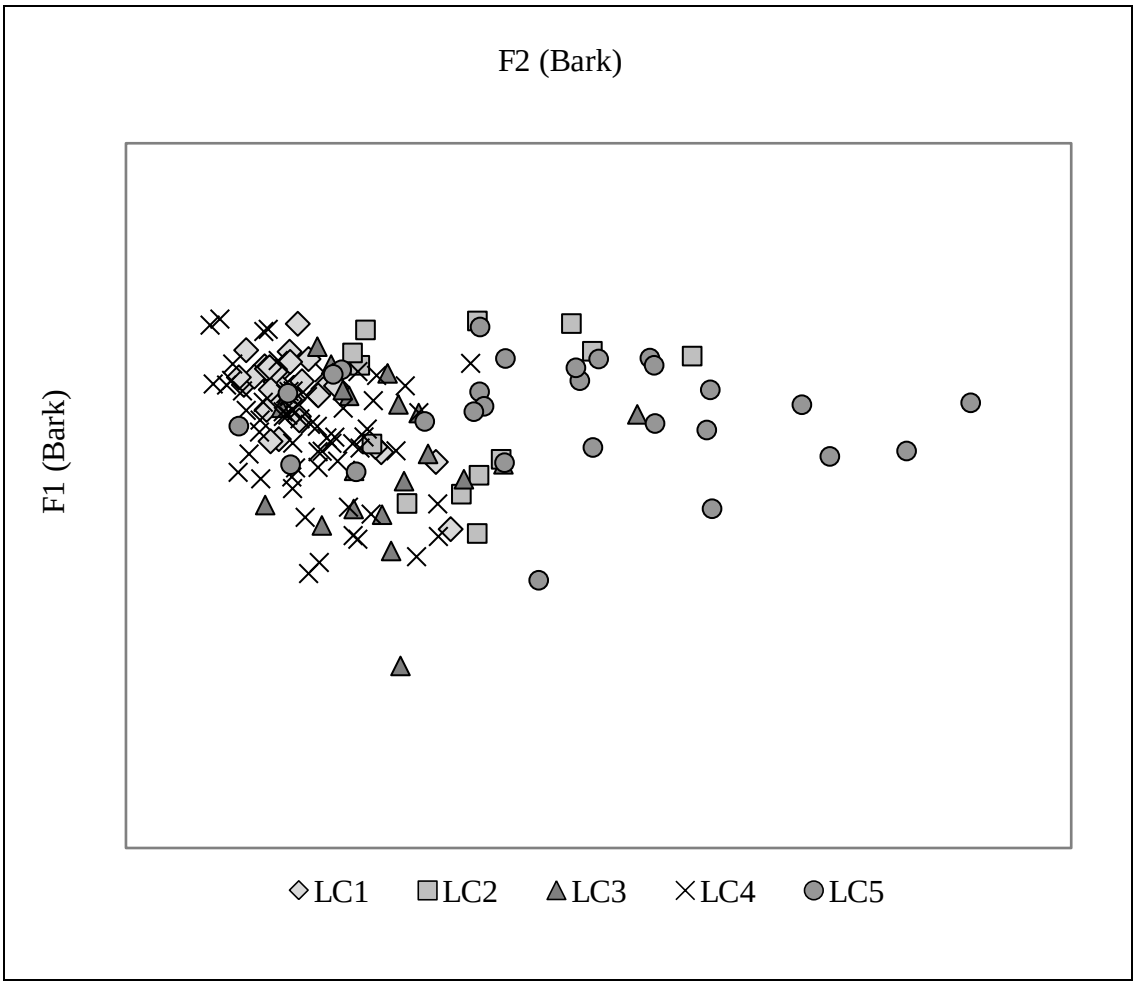


Figure 4.4: Scatter Plot for MPC /e/

As observed in Figure 4.4, the position of the vowels produced by LC5 are spread further back in the vowel space. In view of this, further analysis was carried out on the /e/ words pronounced by LC5 based on CVC and CV syllables (see APPENDIX C2). The CVC syllable words are *s**e**z* 'six' and *d**e**s* 'ten', while the CV syllable words with /e/ are *p**e**si* 'fish', *p**e**gah* 'hold', *s**e**du* 'early', *s**e**ku* 'dry', *az**e**ti* 'oil', *d**e**sah* 'these', *dis**e**s* 'sixteen' and *mb**e**s* 'a little'; *faz**e**h 'do', kuz**e**h 'cook', prend**e**h 'learn'* (see Table 4.5). When categorizing MPC words by its syllable type, it has to be kept in mind that MPC words often contain a silent orthographical 'h' at the end of words. As the 'h' is not pronounced, the final syllables in the words *faz**e**h*, *kuz**e**h* and *prend**e**h* are CV because their IPA transcription would be /faze/, /kuze /, and /prende/. A scatter plot of all the /e/ vowels by LC5 is shown in Figure 4.5. Unlike the comparison in Figure 4.3 for /i/, no clear distinction between the /e/ produced by LC5 in CV and CVC syllables was found as can be seen in Figure 4.5. Thus, it remains unclear why LC5 produced some of her vowels further back. Also, as there were less than ten instances of words with CVC syllables, no statistical test was performed to compare the differences.

Table 4.5: CV and CVC syllables /e/ words produced by LC5

| CV Syllable Words and frequencies | | | CVC Syllable Words and frequencies | | |
|---|---|---|---|---|---|
| MPC Words | | Meaning | MPC Words | | Meaning |
| (1) | seti | seven | (4) | *sez* | six |
| (3) | pesi | fish | (2) | *des* | ten |
| (1) | pegah | hold | (2) | *dises* | say |
| (1) | sedu | early | | | |
| (2) | seku | dry | | | |
| (1) | azeti | oil | | | |
| (2) | desah | these | | | |
| (3) | mbes | a little | | | |
| (11) | fazeh | do | | | |
| (6) | prendeh | learn | | | |
| (2) | sabeh | know | | | |
| (2) | kuzeh | cook | | | |
| (5) | akeh | those | | | |
| (2) | nteh | don’t have | | | |
| (1) | fubeh | boil | | | |
| (2) | bebeh | drink | | | |

LC = Language Consultant

The number in parenthesis indicates the frequency of the word in the selected data

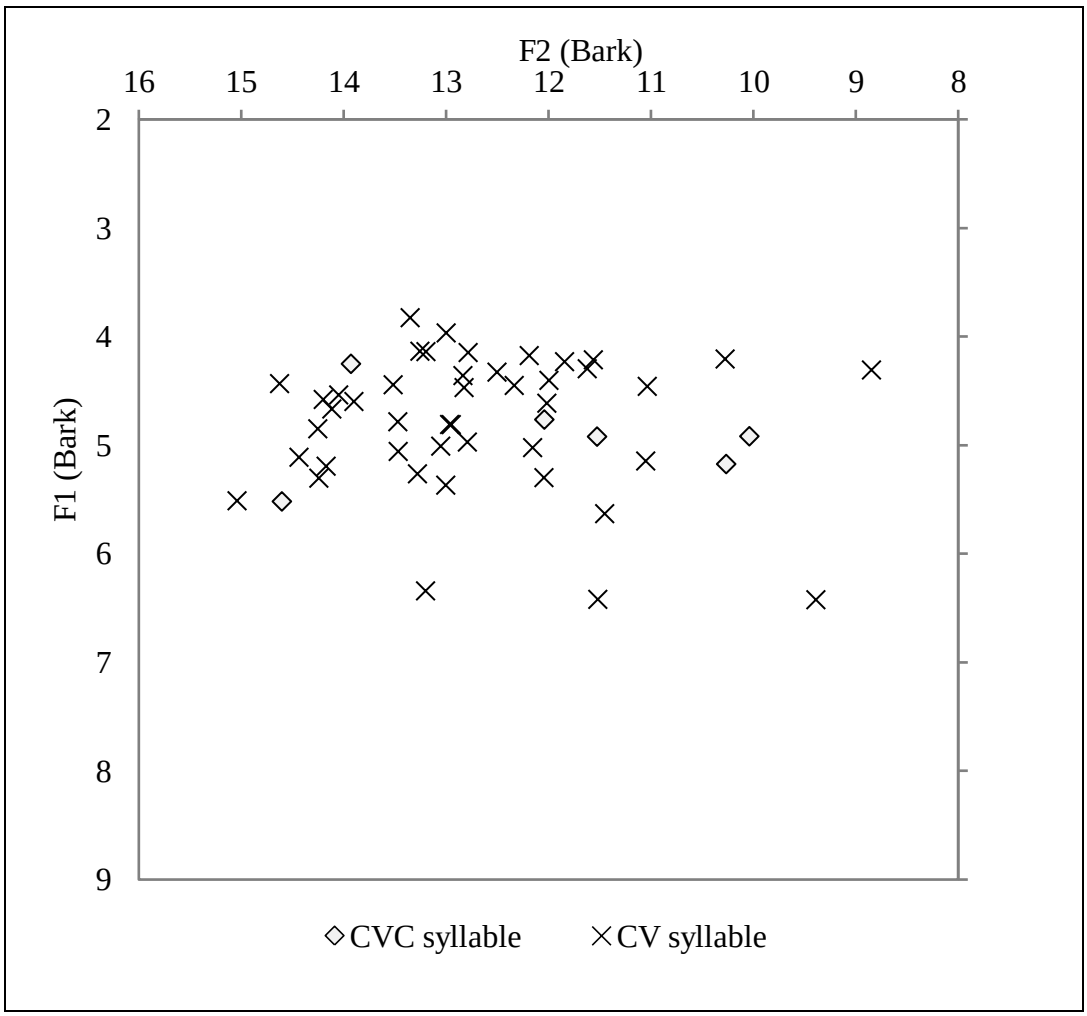

Figure 4.5: Scatter Plot of /e/ for LC5

Baxter (1988, p. 26) points out that there is a contrast between /e/ and /ɛ/ (see 2.5) but that "clear cut cases of contrast are few and seem to be restricted to three environments: before /t/, /s/ and /z/". Thus, based on Baxter's (1988, p.26) description, words like *besu* 'lip' /b**e**su/ and *mesu* 'still' /m**ɛ**su/, *retu* 'correct' /r**e**tu/ and *ketu* 'quiet' /k**ɛ**tu/, *tezu* 'tight' /t**e**zu/ and *r**e**zu* 'prayer' /r**ɛ**zu/ contain different vowels. A comparison of the F1 and F2 values for what was deemed to be /e/ in this study located before /t/, /s/, and /z/ was carried out (see APPENDIX C3). Table 4.6 provided the list of words for /e/ before /t/, /s/ and /z/. Figure 4.6 displays the distribution of this vowel preceding /t/, /s/ and /z/. However, by grouping /e/ vowel samples when preceding /t/, /s/ and /z/, no specific pattern was observed. A one-way ANOVA showed that there were no

significant differences between the F1 and F2 means of the /e/ vowels in the three environments, F (2, 40) = 4.01, p = 0.0259), F (2, 40) = 0.79, p = 0.4608.

Table 4.6: List of Words for /e/ before /t/, /s/ and /z/ Environment

| /e/ before /t/ Words and frequencies | | | /e/ before /s/ Words and frequencies | | | /e/ before /z/ Words and frequencies | | |
|---|---|---|---|---|---|---|---|---|
| MPC Words | | Meaning | MPC Words | | Meaning | MPC Words | | Meaning |
| (2) | Seti | seven | (2) | festival | festival | (5) | sez | six |
| (1) | azeti | oil | (13) | pesi | fish | | | |
| | | | (1) | desa | these | | | |
| | | | (1) | sesta | fifth | | | |
| | | | (2) | sestafera | Friday | | | |
| | | | (1) | peskədor | fisherman | | | |
| | | | (2) | desah | those | | | |
| | | | (7) | mbes | a little | | | |
| | | | (2) | bes | a bit | | | |
| | | | (3) | des | ten | | | |
| | | | (1) | dises | sixteen | | | |

LC = Language Consultant

The number in parenthesis indicates the frequency of the word in the selected data

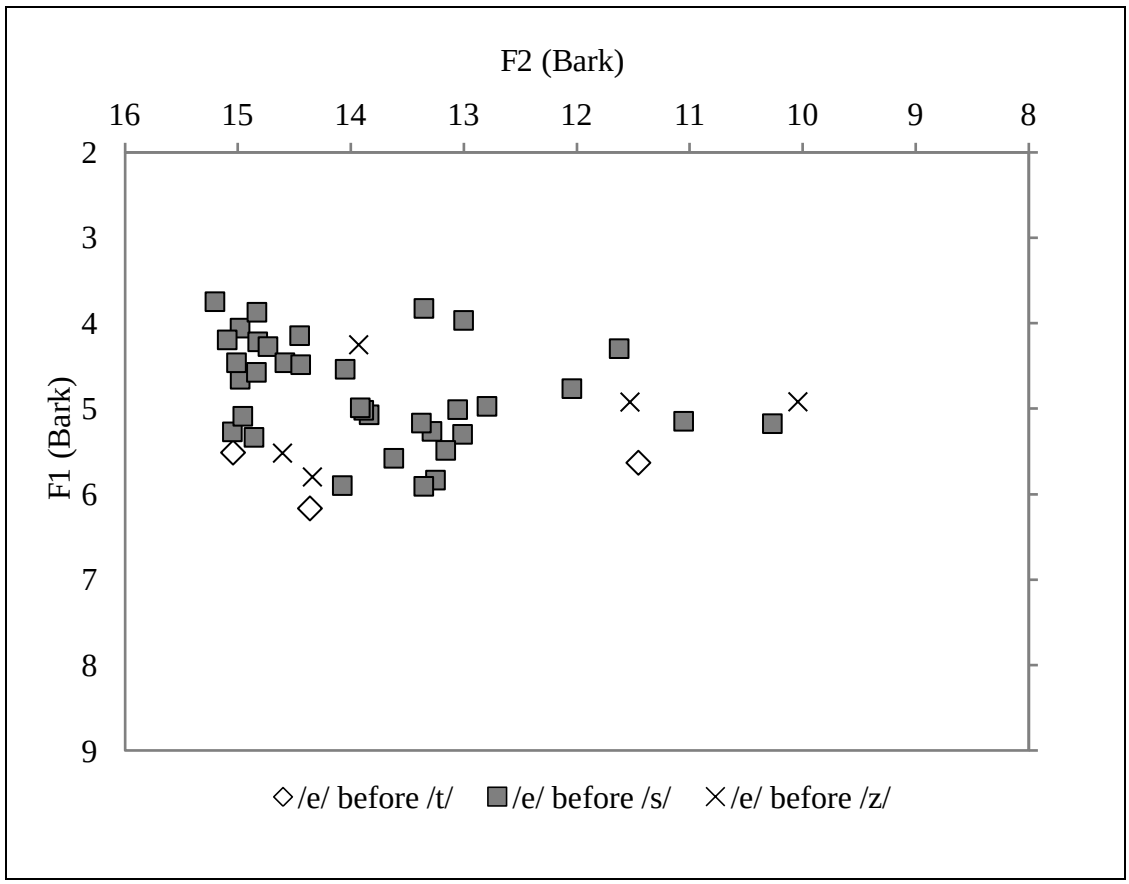


Figure 4.6: Scatter Plot for MPC /e/ preceding /t/, /s/ and /z/

Based on Baxter's (1988, p.26) list of words in these environments (see Table 2.4), the same words in this study were further examined to see if there were differences in vowels quality. Two words that appear in Baxter's (1988, p.26) list as being produced with an /ɛ/, *s**e**ti* 'seven', and with an /e/, *az**e**ti* 'oil', were found in the data (see APPENDIX C4).

Figure 4.7 displays the scatter plot of these vowels as they were produced in the two words, where it can be seen that the vowel in *s**e**ti* does not appear to be produced lower in the vowel space. However, with only three words from the data, it is not possible to come to any concrete conclusions about whether there is a vowel distinction in some V+ /t s z/ environments.

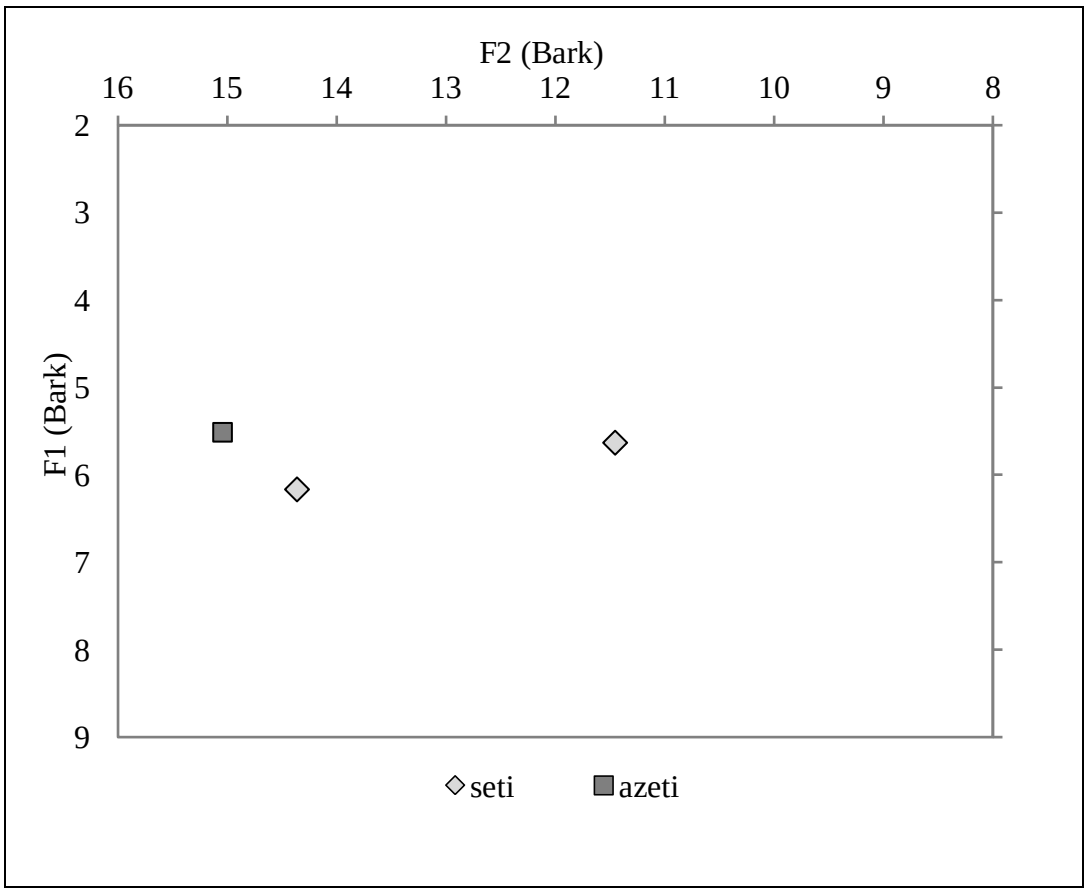


Figure 4.7: Scatter Plot for Vowels in ***s**eti* and *az**e**ti***

Baxter (1988) also suggests that the distribution of /e/ - /ɛ/ is a result of vowel harmony (refer 2.5). To examine if this pattern applies to MPC /e/ in this study, all the words extracted for /e/ were grouped based on whether the following syllables contained high (namely /i/ and /u/ in the following syllables in the selected data) and low (namely /a/) vowels (see APPENDIX C5). Though MPC /e/ is also a high vowel as depicted in Figure 4.1, words such as ***b**ebeh*, where /e/ is followed by another /e/ vowel, were excluded from this section. Figure 4.8 displays the scatter plot of /e/ grouped by the height of the vowels in the following syllable. As can be seen in Figure 4.8, the majority of the /e/ vowels which are followed by /i/ and /u/ tend to be produced higher and more fronted in the vowel space, while those followed by /a/ are scattered slightly lower. It can be observed in Figure 4.8 that two out of three instances of ***s**eku* were located at the bottom right corner. Since F1 correlates inversely to vowel height (see 2.8), this

suggests that there is no difference in vowel height due to the influence of the vowel in the following syllable. Table 4.7 provides the list of words in both environments from the current study. No independent sample t-test was performed as there are less than ten instances of /e/ occurring before low vowels.

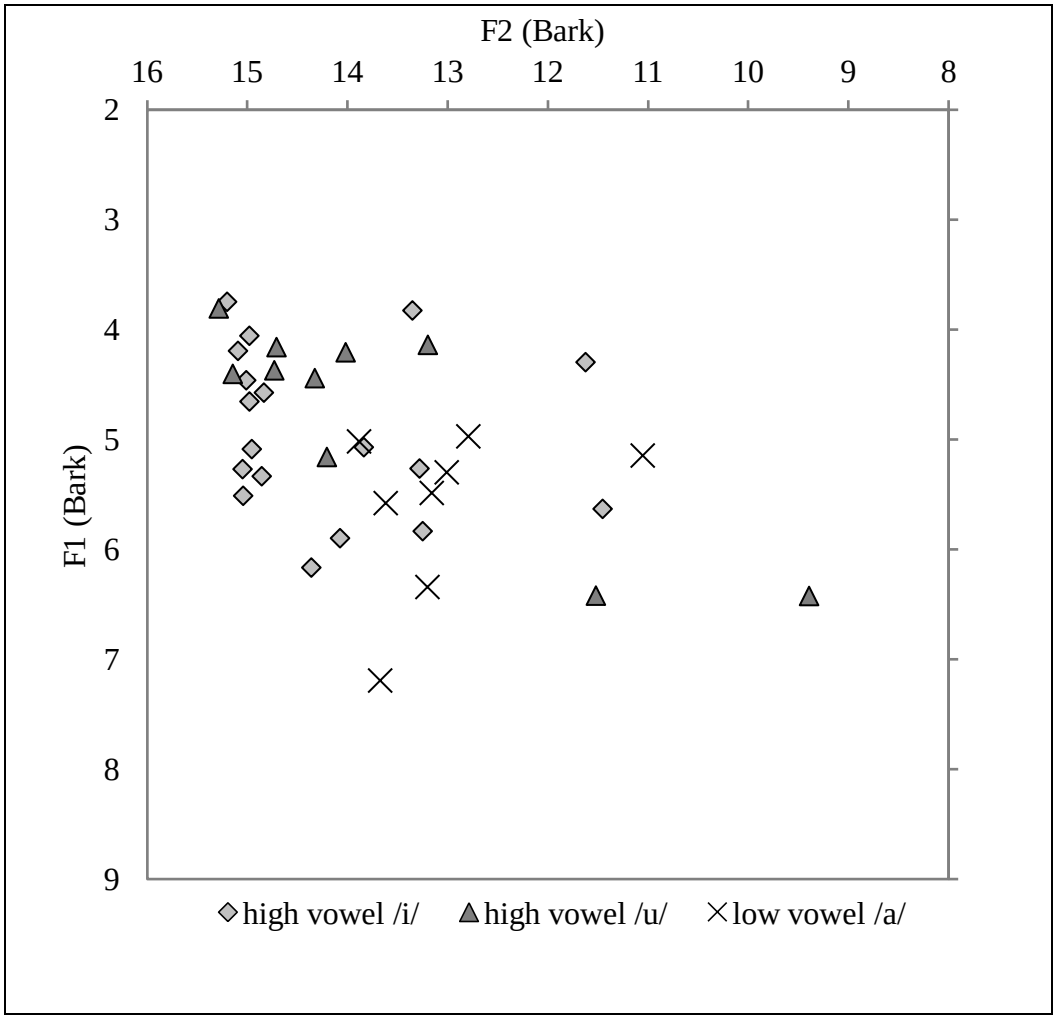


Figure 4.8: Scatter Plot for MPC /e/ Based on Height of Following Vowels

Table 4.7: List of Words with /e/ Based on Height of following Vowels

| High Vowel in the Following Syllable | | | Low Vowel in the Following Syllable | | |
|---|---|---|---|---|---|
| MPC Words | | Meaning | MPC Words | | Meaning |
| (2) | *Seti* | seven | (1) | *Desa* | allow |
| (2) | *festival* | festival | (1) | *sesta* | fifth |
| (13) | *pesi* | fish | (2) | *sestafera* | Friday |
| (1) | *azeti* | oil | (1) | *pegah* | Catch |
| (2) | *pedru* | peter | (1) | *kebrah* | Spoil |
| (5) | *sedu* | early | (2) | *desah* | these |
| (3) | *seku* | dry | | | |

LC = Language Consultant
The number in parenthesis indicates the frequency of the word in the selected data

### 4.2.3 MPC /ə/

The MPC monophthong /ə/ was extracted from words such as *festibəl* 'festival', *kazə* 'married', *batatə* 'potato', *peskədor* 'fishermen', *pəgah* 'hold' (see APPENDIX B3). From Figure 4.9 it can be observed that the vowels produced by LC4 and LC5 are relatively scattered at the fronter and more back zone in the vowel space. Meanwhile, LC1 produced /ə/ at more front area of the scatter plot. Table 4.8 provides the formant measurements of this vowel for all the LCs. It is observed that LC4 produced /ə/ with a great level of F2 variation ranged from 1142.83Hz to 2445.35Hz within herself. Such feature of speaker variation can relate to the instability form of MPC vowels, which is commonly noticed in endangered languages.

Table 4.8: Formant Measurements for MPC Vowel /ə/

| LC | Ave. F1 and SD (Hz) | Minimum (above) and Maximum (below) F1 (Hz) | Ave. F2 and SD (Hz) | Minimum (above) and Maximum (below) F2 (Hz) |
|---|---|---|---|---|
| 1 | 545.60<br>(85.60) | 414.81<br>660.18 | 2112.00<br>203.67 | 1784.32<br>2430.14 |
| 2 | 481.72<br>(38.41) | 431.91<br>533.60 | 1647.19<br>244.96 | 1327.86<br>1935.36 |
| 3 | 640.12<br>(36.32) | 599.28<br>668.78 | 1760.80<br>145.33 | 1626.17<br>1914.88 |
| 4 | 555.36<br>(65.84) | 436.71<br>673.16 | 1834.70<br>341.86 | 1142.83<br>2445.35 |
| 5 | 562.95<br>(79.70) | 472.25<br>782.55 | 1470.85<br>246.83 | 1001.35<br>1833.53 |

LC = Language Consultant
Ave. = Average
SD = Standard Deviation
*SD values are listed in parenthesis.

A one-way ANOVA of three LCs was performed, and no significant differences between their average F1 were found, $F(2, 49) = 0.18$, $p = 0.8358$. This indicates that in terms of vowel height, the vowel /ə/ was produced in a similar way by all the LCs. LC2

and LC3 were excluded from analysis as there were less than ten instances of words containing /ə/ from the selected data.

A one-way ANOVA showed that there were significant differences between the average F2 means of the three LCs, $F(2, 49) = 19.95$, $p < .0001$. Tukey post-hoc comparisons of the three LCs show that the F2 means were different only between LC1 (M = 2111.9Hz, SD = 203.8Hz) and LC4 (M = 1834.7Hz, SD = 341.7Hz), LC1 and LC5 (M = 1470.9Hz, SD = 246.9Hz) and LC4 and LC5. This indicates that the three LCs generally produced the vowel /ə/ similarly in terms of how vowel dispersed they were in the vowel space.

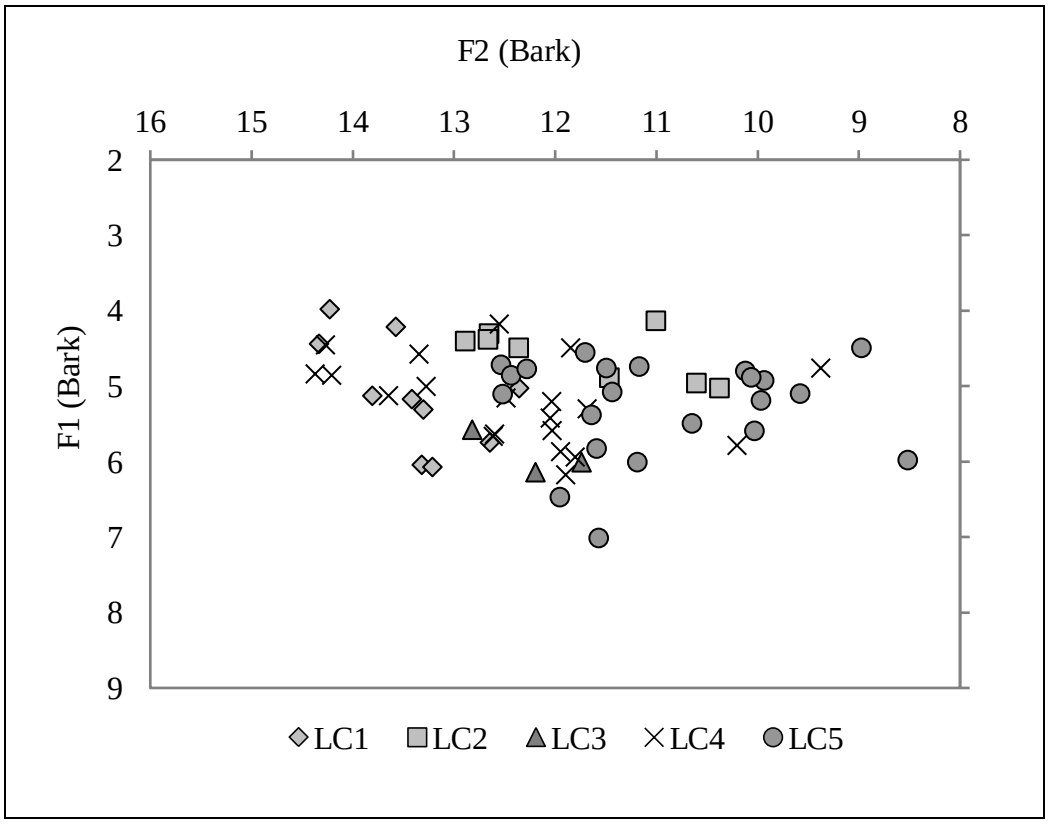


Figure 4.9: Scatter Plot for MPC /ə/

The vowel /ə/ occurred only in unstressed syllables in CVC or CV environments (see APPENDIX C6). As the orthographical 'h' in words like *bo<u>teh</u>* 'put' and *ka<u>beh</u>*

containing /ə/ is not pronounced, the syllable structure is CV, and hence, their IPA transcriptions are /botə/ and /kabə/. The CVC syllable words are *festib**e**l* ‘festival’; while the CV syllable words with /ə/ are /satentə/ ‘sixty’, /pəgah/ ‘catch’, /yosə/ ‘my’, /kazə/ ‘house’, /jə/ ‘already’, /batatə/ potatoes’, /botəh/ ‘put’, /kabəh/ ‘finished’, (see Table 4.9). As can be seen in Figure 4.10, no differences were found between /ə/ produced in CVC or CV word final syllable positions based on the generated scatter plot. No statistical tests were performed as there were less than ten words for /ə/ in non-final CVC syllable position. It can be said that the CV or CVC syllable arrangement of /ə/ did not affect the vowel’s quality.

Table 4.9: List of Words for /ə/ Words in CV and CVC Syllables

| CV Syllable Words and frequencies | | | CVC Syllable Words and frequencies | | |
|---|---|---|---|---|---|
| MPC Words | | Meaning | MPC Words | | Meaning |
| (11) | satenta | seventy | (2) | festibəl | Festival |
| (1) | pegah | catch | | | |
| (1) | portugis | portuguese | | | |
| (6) | yosa | my | | | |
| (7) | kaza | house | | | |
| (4) | ja | already | | | |
| (2) | batata | potato | | | |
| (5) | boteh | put | | | |
| (1) | botek | put | | | |
| (1) | trempe | seasoning | | | |

Table 4.9: List of Words for /ə/ words in CV and CVC syllables (continue)

| CV Syllable Words and frequencies | | | CVC Syllable Words and frequencies | | |
|---|---|---|---|---|---|
| MPC Words | | Meaning | MPC Words | | Meaning |
| (10) | kabeh | finished | | | |
| (3) | fikeh | stay | | | |
| (1) | te | you | | | |
| (3) | ka | (*fika*) stay | | | |
| (1) | akeh | those | | | |
| (2) | tokeh | play | | | |
| (1) | ngka | never | | | |
| (1) | butika | shop | | | |
| (1) | bokeh | mouth | | | |
| (1) | mandah | send | | | |
| (1) | labah | wash | | | |
| (1) | desah | these | | | |
| (1) | korteh | cut | | | |
| (3) | sesenta | sixty | | | |
| (1) | peskador | fisherman | | | |

LC = Language Consultant

The number in parenthesis indicates the frequency of the word in the selected data

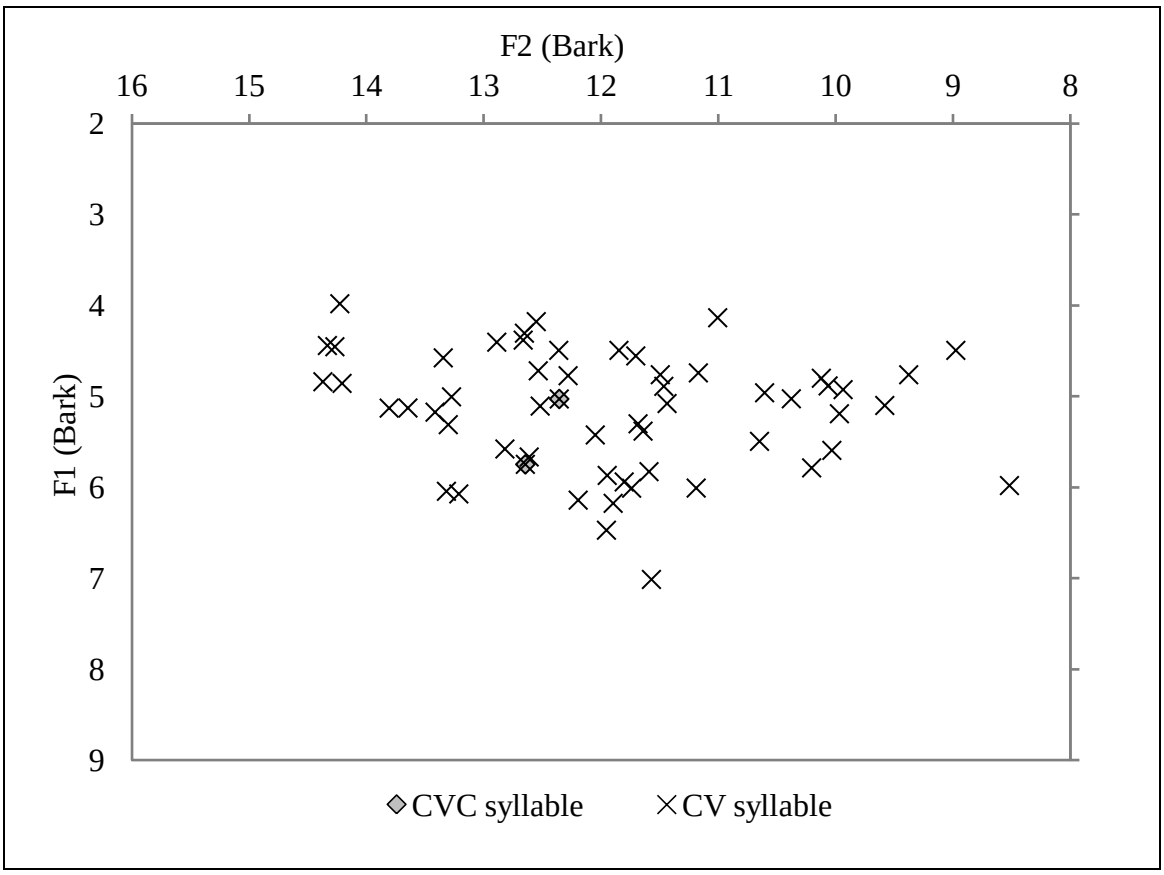

Figure 4.10: /ə/ Scatter Plot by CVC and CV Syllables

### 4.2.4 MPC /u/

The MPC monophthong /u/ was extracted from words such as *t**u**du* ‘all’, *k**u**k**u**s* ‘steam’, *port**u**gis* ‘portuguese’, *b**u**tika* ‘shop’, and *f**u**beh* ‘boil’ (see APPENDIX B4). Table 4.10 provides the formant values for MPC /u/. The F2 min and max of LC1, LC4 and LC5 are observed to vary across a great range of within speaker variation. On the contrary, the F2 values of LC3 indicate a consistent and less drastic variation across the collection of vowel tokens produced by LC3. From Figure 4.11 it can be observed that the distribution for /u/ is scattered in the vowel space, suggesting considerable variation in the way that it is produced. It can also be seen that the vowels produced by LC4 and LC5 appear to right across the vowel chart.

Table 4.10: Formant Measurements for MPC Vowel /u/

| LC | Ave. F1 and SD (Hz) | Minimum (above) and Maximum (below) F1 (Hz) | Ave. F2 and SD (Hz) | Minimum (above) and Maximum (below) F2 (Hz) |
|---|---|---|---|---|
| 1 | 428.06<br>(49.06) | 355.07<br>628.60 | 1579.86<br>392.29 | 866.50<br>2430.99 |
| 2 | 418.69<br>(43.12) | 352.57<br>504.31 | 1376.95<br>159.40 | 1078.48<br>1638.95 |
| 3 | 514.16<br>(77.69) | 459.23<br>569.09 | 1371.08<br>177.61 | 1245.49<br>1496.67 |
| 4 | 500.21<br>(50.14) | 384.39<br>601.39 | 1624.15<br>273.18 | 1007.33<br>2091.44 |
| 5 | 485.44<br>(59.25) | 387.64<br>614.20 | 1570.27<br>316.00 | 894.57<br>2145.51 |

LC = Language Consultant
Ave. = Average
SD = Standard Deviation
*SD values are listed in parenthesis.

A one-way ANOVA showed that there were significant differences between the F1 means of four LCs (LC3 was removed for analysis as there were only two instances of

words containing /u/ from the data selected): F (3, 108) = 17.83, p < .0001. Tukey post-hoc comparisons of the four LCs show that the F1 means were significantly different except for between LC1 (M = 428Hz, SD = 49.1Hz) and LC2 (M = 418.7Hz, SD = 43Hz), LC4 (M = 500Hz, SD = 50.1Hz) and LC5 (M = 485.4Hz, SD = 59.2Hz). This indicates that there was considerable difference in vowel height for /u/.

A one-way ANOVA also showed that there were significant differences between the F2 means of the four LCs, F (3, 108) = 2.69, p = 0.049. This indicates that the four LCs produced the vowel /u/ similarly in terms of how vowel advanced or retracted they were in the vowel space. Tukey post-hoc comparisons of the four LCs show that the F2 means were significantly different for LC2 (M = 1377Hz, SD = 159.4Hz) and LC4 (M = 1624.2Hz, SD = 273.2Hz). This dispersion is visible in Figure 4.11.

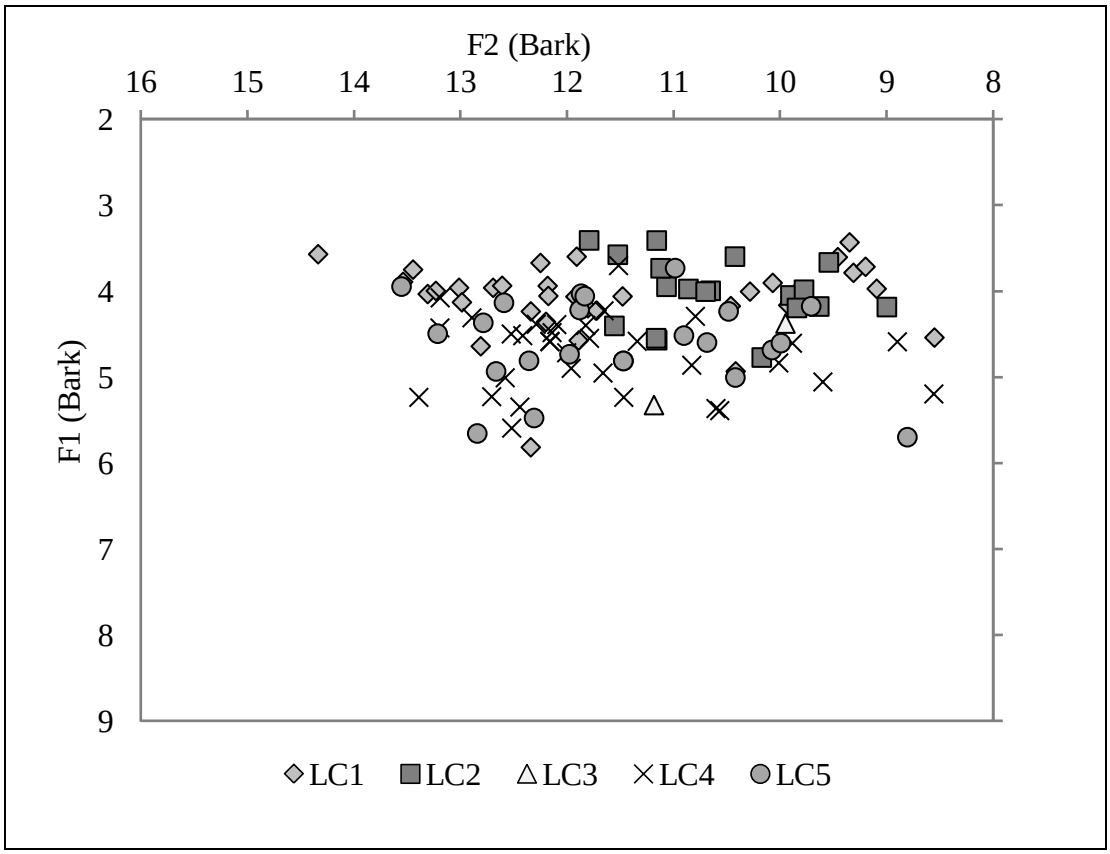


Figure 4.11: Scatter Plot for MPC /u/

In order to find out if the position of the vowel in particular syllable environment (see APPENDIX C7) had any effect on /u/, a scatter plot was produced by grouping its syllable conditions (Figure 4.12). Table 4.11 shows the list of words in CVC and CV combinations. From the scatter plot, no differences were found between /u/ which occurred in CVC or CV syllables. The vowels from each group are scattered evenly regardless of their syllable combination. No statistical tests were performed as there were less than ten instances of CVC syllables with /u/ in them.

Table 4.11: List of Words for /u/ words in CV and CVC Syllables

| CV Syllable Words and frequencies | | | CVC Syllable Words and frequencies | | |
|---|---|---|---|---|---|
| MPC Words | | Meaning | MPC Words | | Meaning |
| (1) | singku | five | (2) | kukus | steam |
| (37) | tudu | all | | | |
| (6) | ku | with | | | |
| (2) | justu | only | | | |
| (1) | nubu | new | | | |
| (3) | sabdu | Saturday | | | |
| (10) | olotu | they | | | |
| (4) | machu | male | | | |
| (1) | retu | agree | | | |
| (2) | kazamintu | wedding | | | |
| (1) | nuibu | bridegroom | | | |
| (1) | fiku | stay | | | |
| (1) | fritu | fry | | | |
| (1) | bredu | vegetables | | | |

LC = Language Consultant

The number in parenthesis indicate the frequency of the word in the selected data

Table 4.11: List of Words for /u/ words in CV and CVC syllables (continue)

| CV Syllable Words and frequencies | | | CVC Syllable Words and frequencies | | |
|---|---|---|---|---|---|
| MPC Words | | Meaning | MPC Words | | Meaning |
| (1) | nitu | grandson | | | |
| (1) | portugis | portuguese | | | |
| (13) | kuzinyah | cook | | | |
| (4) | butika | shop | | | |
| (7) | kuzeh | cooking | | | |
| (1) | judah | help | | | |
| (1) | susi | sister | | | |
| (1) | fubeh | boil | | | |

LC = Language Consultant

The number in parenthesis indicates the frequency of the word in the selected data

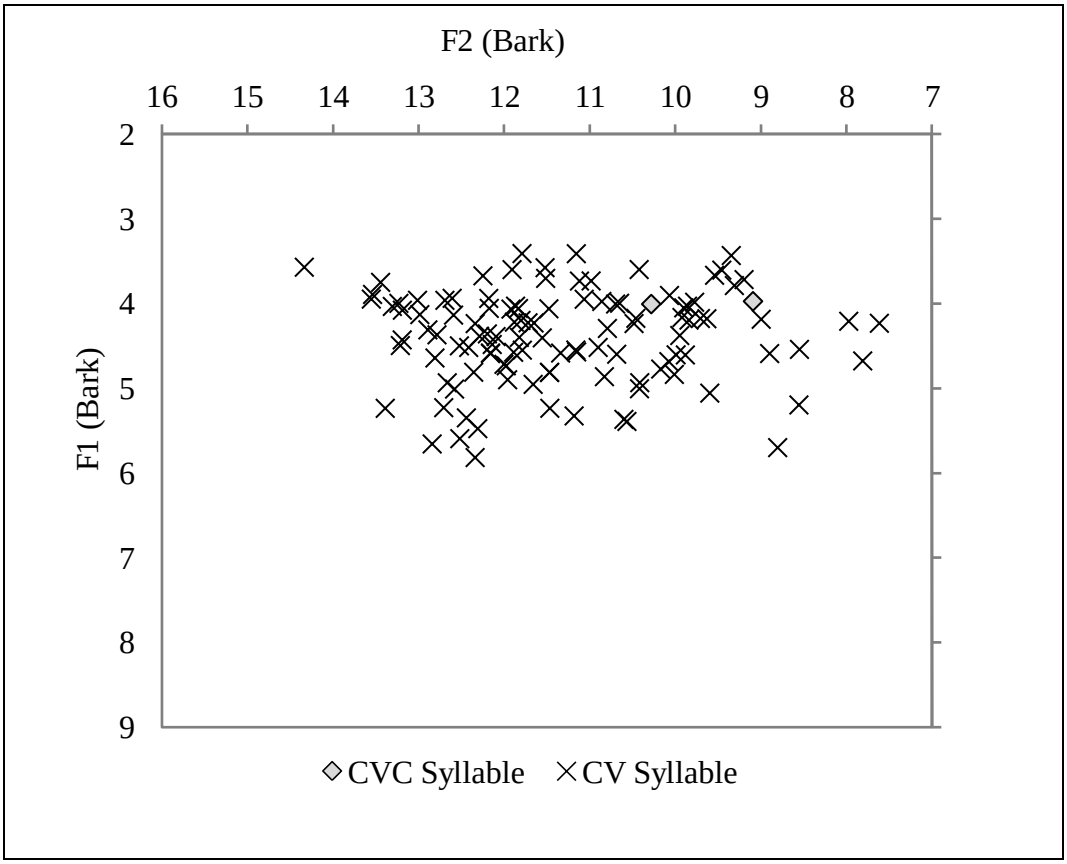


Figure 4.12: Scatter Plot of /u/ by Syllable Position

### 4.2.5 MPC /ɔ/

The MPC monophthong /ɔ/ was extracted from words such as *g**o**stah* ‘like’, *ab**o**h* ‘grandparent’, p**o**di ‘can’, *b**o**s* ‘your’, *resp**o**stah* ‘response’, and *mp**o**ku* ‘a little’ (see APPENDIX B5). Table 4.12 provides the formant values of /ɔ/ for each LC. Again, LC5 is observed to have widest F2 min and max range variation while producing /u/. This variation within an LC suggests that the MPC vowel, being endangered, is starting to lose its form, in which it is being pronounced by random decisions during conversation. Figure 4.13 the distribution for /ɔ/ is scattered in the vowel space, suggesting considerable variation in the way that it is produced.

Table 4.12: Formant Measurements for MPC Vowel /ɔ/

| LC | Ave. F1 and SD (Hz) | Minimum (above) and Maximum (below) F1 (Hz) | Ave. F2 and SD (Hz) | Minimum (above) and Maximum (below) F2 (Hz) |
|---|---|---|---|---|
| 1 | 608.95<br>(51.73) | 533.57<br>687.62 | 1506.70<br>273.80 | 923.44<br>1768.34 |
| 2 | 519.20<br>(78.99) | 432.92<br>625.96 | 1160.26<br>220.73 | 835.24<br>1522.41 |
| 3 | 568.75<br>(71.62) | 462.74<br>739.25 | 1079.78<br>160.39 | 888.44<br>1415.81 |
| 4 | 587.46<br>(91.84) | 406.72<br>768.29 | 1060.13<br>204.56 | 698.71<br>1471.53 |
| 5 | 595.22<br>(88.18) | 440.00<br>760.70 | 1262.73<br>255.05 | 913.98<br>2102.77 |

LC = Language Consultant
Ave. = Average
SD = Standard Deviation
*SD values are listed in parenthesis.

However, a one-way ANOVA showed that there were no significant differences between the F1 means of four LCs (LC1 was removed for analysis as less than ten words containing /ɔ/ were selected for analysis), F (3, 96) = 2.65, p = 0.532. As F1 value correlates with vowel height, this suggests that all the LCs produced /ɔ/ with similar vowel height.

In contrast, a one-way ANOVA showed there were significant differences between the average F2 means of four LCs, F (3, 96) = 5.67, p < .01. Tukey post-hoc comparisons of the four LCs show that the F2 means were significantly different only between LC3 (M = 1079.8Hz, SD = 160.4Hz) and LC5 (M = 1262.7Hz, SD = 255Hz), LC4 (M = 1060.1Hz, SD = 204.6Hz) and LC5. This is consistent with what is presented in the scatter plot in Figure 4.12 where it can be seen that the vowel /ɔ/ produced by LC5 was produced further front in the vowel space compared to those of the other LCs.

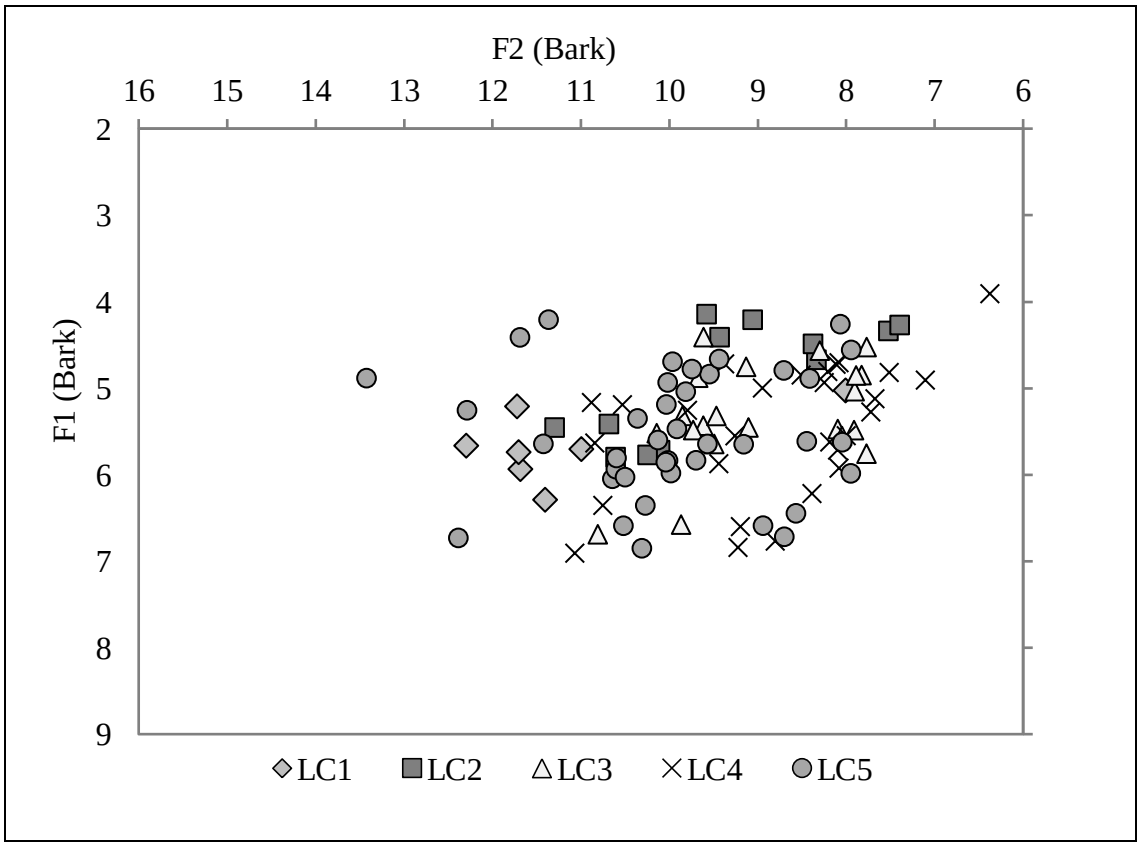


Figure 4.13: Scatter Plot for MPC /ɔ/

Baxter's (1988, p. 26- 27) posits that there is /o/ and /ɔ/ contrast in some words before /t/, /d/ and /l/ (see 2.5) and in particular "preferred environments". However, unlike the attempt with /e/ and /ɛ/ earlier in this chapter, none of the words in Baxter's (1988, p. 27) list (as presented in Table 2.5) were found in the current study, limiting the attempt to find clues of /o/ and /ɔ/ distinction from Baxter's list of words.

The list of words with /ɔ/ preceding /d/ and /t/ from this study is shown in Table 4.13 (see APPENDIX C8). No instances of neither /o/ nor /ɔ/ preceding /l/ were found in the selected data. The scatter plot of the vowels occurring in all instances of these four words based on whether they occurred before /t/ and /d/ is shown in Figure 4.14.

No statistical tests were run due to small number of tokens. However, as can be discerned in Figure 4.14, the /ɔ/ vowels preceding /t/ are accumulated lower than the /ɔ/ vowel before /d/ compared to the other words containing /ɔ/ in other environment are scattered while overlapping with the Vt and Vd environments. This pattern suggests that there is slight difference in F1 values of both environments. However, the F2 values do not indicate any difference in terms of vowel frontness in both environments. While Baxter's idea was that there will be different /o/ and /ɔ/ phoneme variation within each one group of the /d/, /t/, /l/ words: in other words some /ɔ/ + /d/ and /ɔ/ + /t/ see /ɔ/ being produced higher and some lower (see 2.5), there was no patterns as to which words in which environment tended to be produced lower or higher in the data.

Table 4.13: List of Words with /ɔ/before /t/ and /d/

| /ɔ/ before /t/ Words and frequencies | | | /ɔ/ before /d/ Words and frequencies | | |
|---|---|---|---|---|---|
| MPC Words | | Meaning | MPC Words | | Meaning |
| (15) | botah | put | (6) | podi | can |
| (3) | botak | put | (3) | mpodi | cannot |

LC = Language Consultant
The number in parenthesis indicates the frequency of the word in the selected data

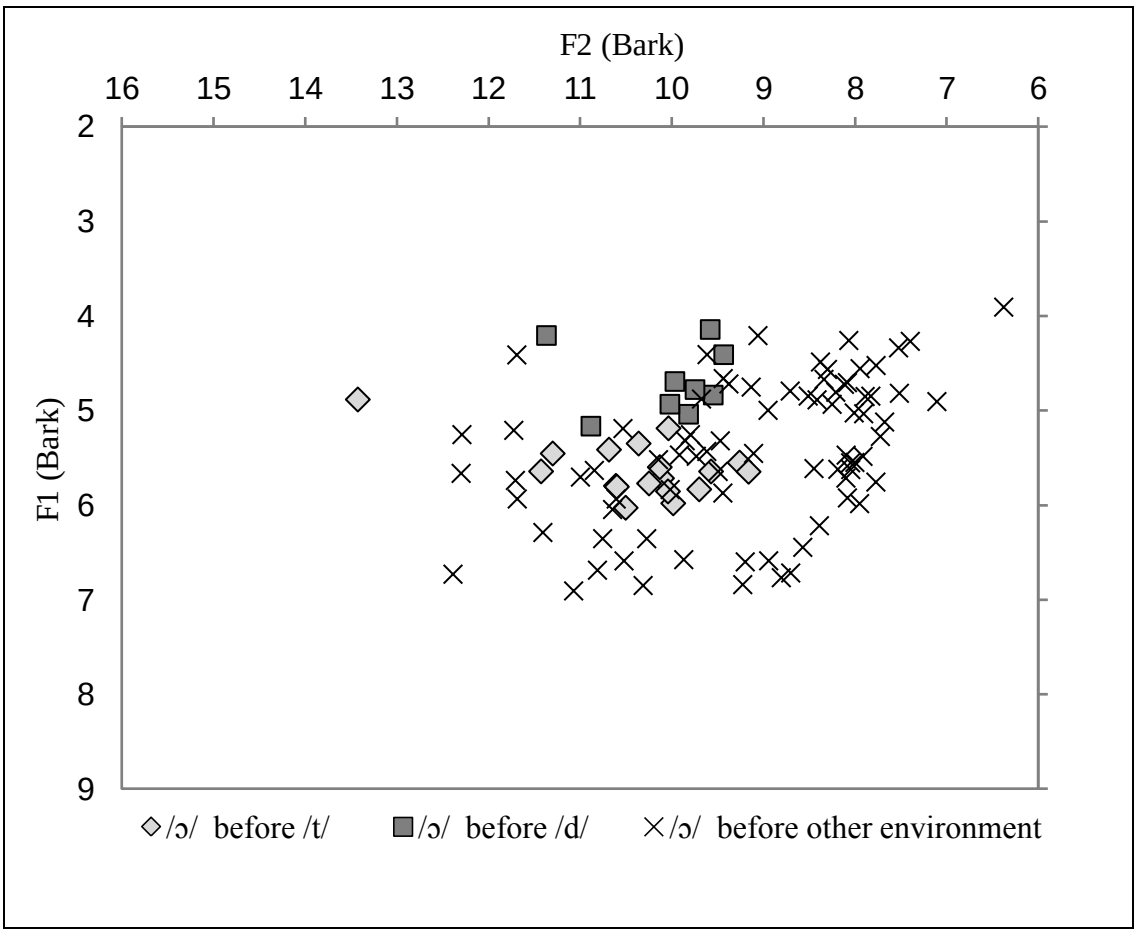


Figure 4.14: Scatter Plot for MPC /ɔ/ preceding /t/ and /d/

Baxter (1988) also suggests that the distribution of the /o/ - /ɔ/ vowel is an effect of vowel harmony (see 2.5). The vowels annotated as /ɔ/ in this study were grouped based

on whether they were followed by high vowels (/i/ and /u/), and low vowels (/a/) as shown in Table 4.14 (see APPENDIX C9). Figure 4.15 indicates that /ɔ/ tends to be produced higher when it is followed by high vowels while the reverse /o/ occurs when it is followed by a low vowel in the following syllable. The possible /o/ - /ɔ/ vowel contrast due to the effect of vowel harmony, as suggested by Baxter (1988) is only slightly noticeable when data is grouped in this way. However, more data are needed to show the existence of such a such pattern as it could be just coincidence in this study, and not a common feature among the majority of MPC speakers.

An an independent t-test showed a significant difference for the mean F1 values of high vowel and low vowel in the following syllable: ($t = 5.2$, $df = 60$, $p < .0001$, two-tailed, independent samples). As F1 correlates to vowel height, the vowel height when /ɔ/ vowels occur before high vowels, and when /o/ vowels occur before low vowels should be significantly different. However, no significant difference was found for the mean F2 values of /ɔ/ before high vowels and /o/ before low vowels: ($t = 2.33$, $df = 60$, $p = 0.0232$, two-tailed, independent samples). Hence, it is concluded that the vowel height of /ɔ/ is influenced by the vowel height of following syllables but F2 values has no effect on both high or low vowels which follow.

Table 4.14: List of Words with /ɔ/ Based on Height of Following Vowels

| High Vowel in the Following Syllable | | | Low Vowel in the Following Syllable | | |
|---|---|---|---|---|---|
| MPC Words | | Meaning | MPC Words | | Meaning |
| (6) | *podi* | can | (14) | Botah | put |
| (3) | *mpodi* | cannot | (3) | botak | put |
| (5) | *mpoku* | a little | (1) | botal | put |
| (1) | *koku* | coconut | (10) | gostah | like |
| (2) | *kofi* | coffee | (1) | bosa | your |
| | | | (10) | tokah | play |
| | | | (3) | angkoza | things |
| | | | (1) | repostah | reply |
| | | | (2) | boka | mouth |

LC = Language Consultant

The number in parenthesis indicates the frequency of the word in the selected data

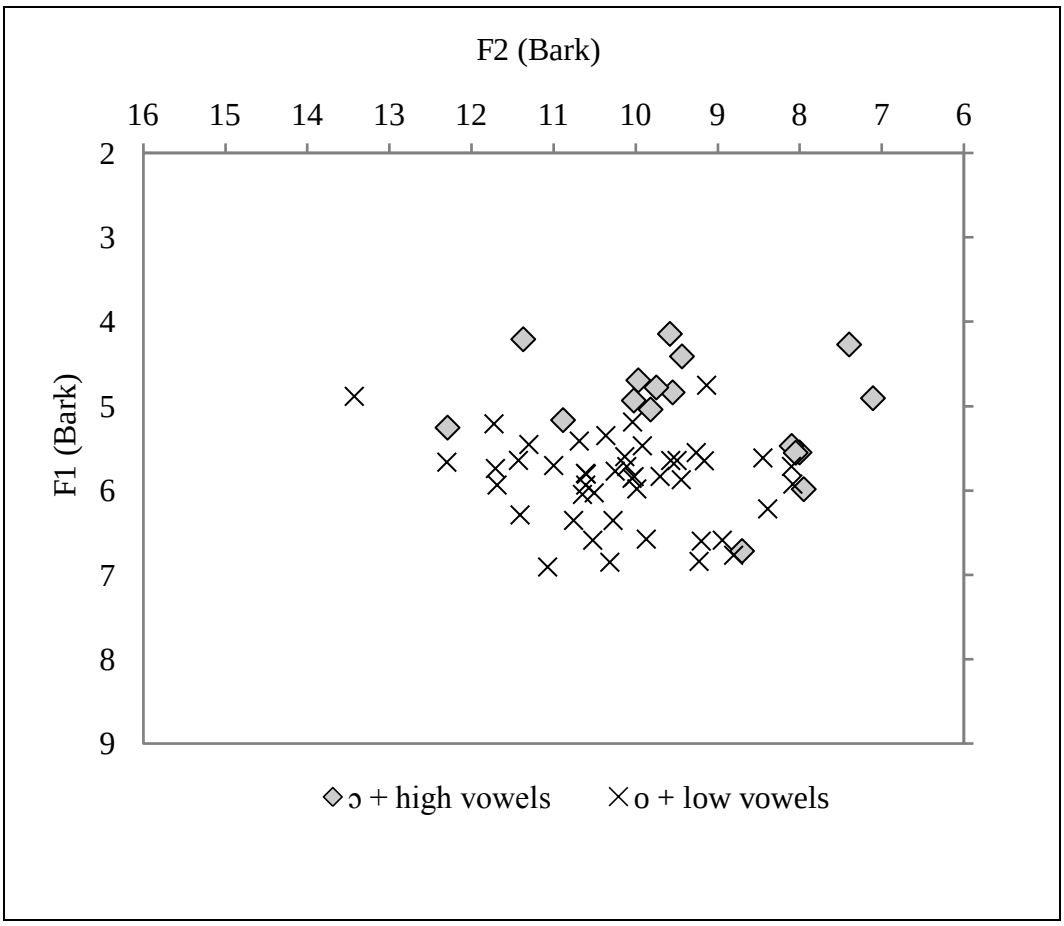


Figure 4.15: /ɔ/ -/o/ Scatter Plot by the Height of Following Vowels

### 4.2.6 MPC /a/

The MPC monophthong /a/ was extracted from words such as *p**a**piah* ‘speak’, *s**a**tenta* ‘seventy’, f**a**zeh ‘do’, *fik**a**h* ‘stay’, *s**a**beh* ‘know’ and *ngk**a*** ‘do not’ (see APPENDIX B6). Table 4.15 provides the formant values for /a/ for each LC. The min and max values of F1 and F2 of LC 3 and LC4 suggest that there is a level of /a/ variation within the sound production of each LC. The tendency of such min and max variation could be due to the bigger collection of selected vowels for /a/ vowels. Also, it can be related to MPC being endangered and starting to lose a stable form of pronunciation not only varied from an LC to another LC, but variation occurred even within one LC. As can be seen in Figure 4.16, the distribution for /a/ is scattered in the vowel space, suggesting considerable variation in the way that it is produced.

Table 4.15: Formant Measurements for MPC Vowel /a/

| LC | Ave. F1 and SD (Hz) | Minimum (above) and Maximum (below) F1 (Hz) | Ave. F2 and SD (Hz) | Minimum (above) and Maximum (below) F2 (Hz) |
|---|---|---|---|---|
| 1 | 762.91<br>(92.78) | 547.54<br>982.84 | 1784.09<br>163.28 | 1477.24<br>1996.79 |
| 2 | 719.87<br>(146.08) | 443.26<br>985.60 | 1639.92<br>151.80 | 1431.42<br>2165.88 |
| 3 | 829.75<br>(129.99) | 531.54<br>1113.89 | 1601.18<br>260.53 | 595.52<br>2344.17 |
| 4 | 713.27<br>(140.08) | 437.80<br>1142.14 | 1620.49<br>278.58 | 690.33<br>2240.58 |
| 5 | 685.88<br>(117.78) | 444.77<br>955.10 | 1520.66<br>203.71 | 1053.43<br>2135.75 |

LC = Language Consultant
Ave. = Average
SD = Standard Deviation
*SD values are listed in parenthesis.

This is consistent with a one-way ANOVA where a significant difference was found between the F1 means of the five LCs, $F(4, 489) = 15.2$, $p < .0001$. Tukey post-hoc comparisons of the five LCs show that the F1 means were significantly different between the speakers except for between LC1 (M =762.9Hz, SD = 92.7Hz) and LC2 (M = 719.8Hz, SD = 146.1Hz), LC1 and LC4 (M = 713.3Hz, SD = 140Hz), LC2 and LC4, LC2 and LC5 (M = 685.9Hz, SD = 117.8Hz), LC4 and LC5. Thus, there were considerable differences between the ways in which the five LCs produced /a/ in terms of vowel height.

Significant differences between the F2 means of the five LC were also found, $F(4, 489) = 12.76$, $p < .0001$. Tukey post-hoc comparisons of the five LCs show that there were the F2 means were significantly different between the LCs except for between LC2 (M = 1639.9Hz, SD = 151.8Hz) and LC3 (M = 1601.2Hz, SD = 260.5Hz), LC2 and LC4 (M = 1620.5Hz, SD = 278.6Hz), LC3 and LC4, LC3 and LC5 (M = 1520.7Hz, SD = 203.7Hz), LC4 and LC5. Consistent with Figure 4.16, the vowels were produced differently by each LC in terms of vowel fronting. In Figure 4.16, the outliers of LC3 and LC4 were *kab**a**h* 'finish' and ***ja*** 'already' respectively. The readings were checked by a second rater and found to be consistent.

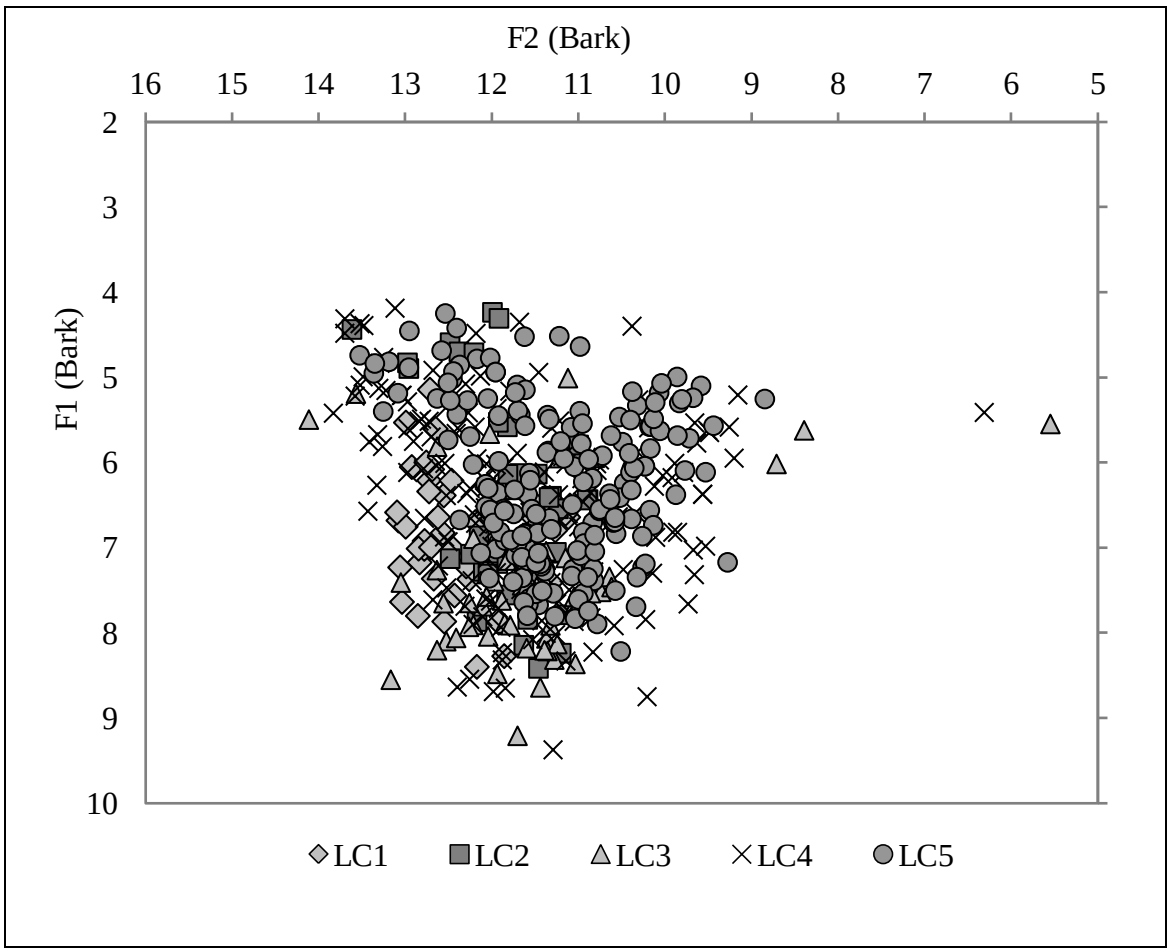


Figure 4.16: Scatter Plot of MPC /a/

In order to find out if the position of the vowel in particular syllable environments had any effect on the /a/ vowels, a list of words is provided in Table 4.16. The complete list of CV syllable words is provided in Appendix (see APPENDIX C10). Figure 4.17 shows /a/ vowel when grouped by its CV or CVC syllables combinations (see APPENDIX C10). As orthographic 'h' is not pronounced in the words *fikah*, *gostah*, *kazah*, *kabah* and *tokah* containing /a/, the final syllables are all CV and their IPA transcription would be /fika/, /gosta/, /kaza/, /kaba/, and /toka/. In Figure 4.17, it can be seen that the vowel height varies among all the CV syllable words. Since only four instances of /a/ in CVC position were available in the selected data, no further

investigation and t-test were performed to see if the vowels dispersion was due to syllable type. Instead the dispersion appeared to be random based on syllable type.

Table 4.16: List of Words of CV and CVC Syllables /a/

| CV Syllable Words and frequencies | | | CVC Syllable Words and frequencies | | |
|---|---|---|---|---|---|
| MPC Words | | Meaning | MPC Words | | Meaning |
| (22) | ngka | don't | (3) | *Sabdu* | Saturday |
| (19) | fikah | stay | (1) | *karipap* | curry puff |
| (9) | gostah | like | | | |
| (3) | dah | give | | | |
| (41) | kaza | home | | | |
| (17) | kazah | married | | | |
| (2) | cha | tea | | | |
| (56) | ja | already | | | |
| (1) | sesta | fifth | | | |
| (2) | sestafera | Friday | | | |
| (10) | botah | put | | | |
| (7) | tokah | knock | | | |
| (1) | lebah | wash | | | |
| (10) | sa | his (possessive) | | | |
| : | : | | | | |
| | Etc* | | | | |

LC = Language Consultant
The number in parenthesis indicates the frequency of the word in the selected data
*See complete listing in APPENDIX C10

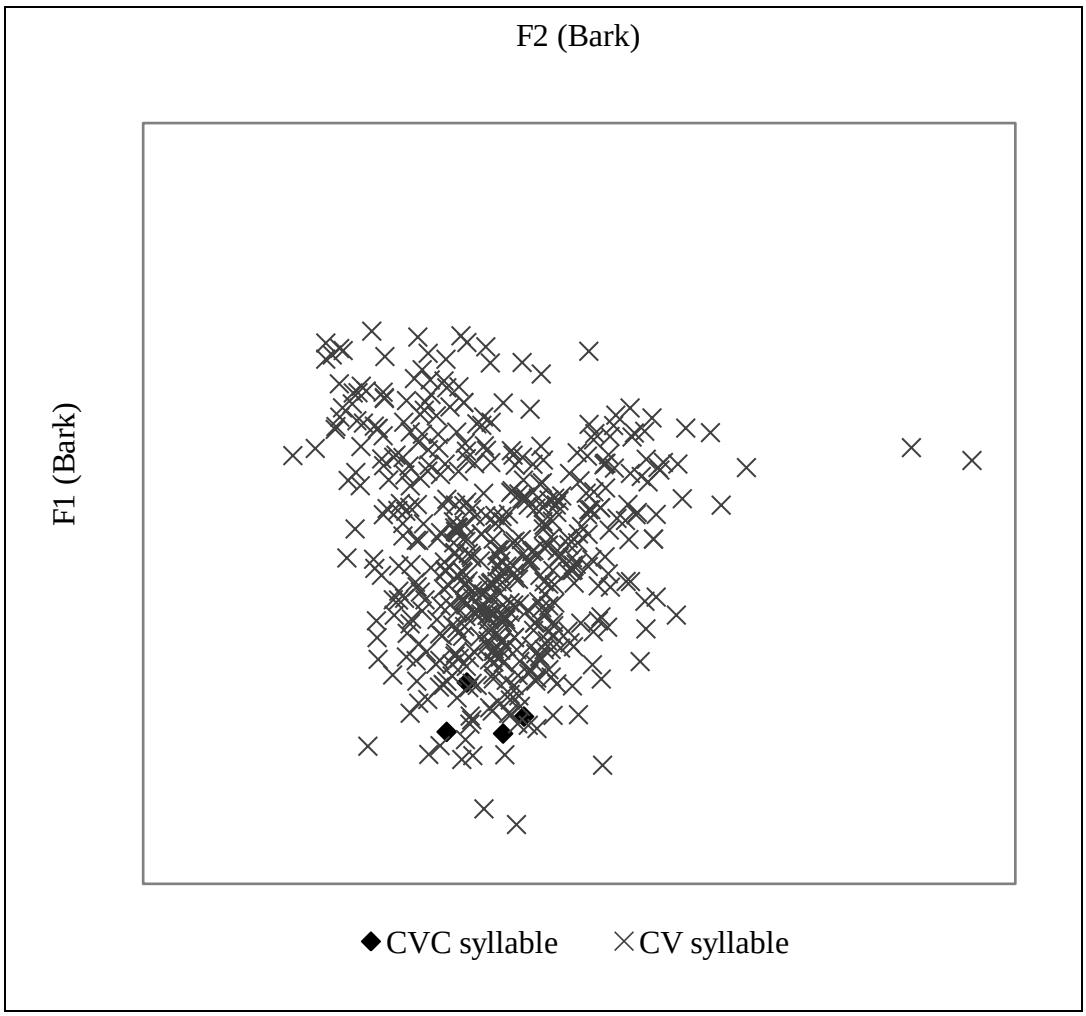

Figure 4.17: Scatter Plot of /a/ by Syllable Position

## 4.3 MPC Vowel Duration

There is no evidence of vowel length contrast in MPC (Baxter & Silva, 2004). Based on the average durations of each vowel, /u/ was found to have the shortest average duration at 78.08ms, while /e/ had the longest average vowel duration of 129.12ms (see Table 4.17). However, based on individual LCs, the duration of /u/ was the shortest for three of the five LCs (LC3, LC4 and LC5); for LC1 and LC2 /i/ and /ə/ had the shortest average durations. For /e/, it was the longest average vowel for only two of the LCs as can be seen in Table 4.17 and Figure 4.18.

Table 4.17: Vowel Duration of MPC Vowels

| | i | e | ə | a | u | ɔ |
|---|---|---|---|---|---|---|
| LC1 | 110.54 (69.54) | 182.53 (111.94) | 174.95 (167.34) | 123.38 (78.29) | 111.12 (69.34) | 216.57 (66.11) |
| LC2 | 80.80 (44.81) | 83.01 (36.50) | 64.00 (30.74) | 109.75 (50.60) | 81.76 (47.44) | 98.29 (25.96) |
| LC3 | 94.19 (82.49) | 74.28 (29.01) | 139.93 (98.78) | 76.25 (50.44) | 58.62 (20.24) | 88.62 (73.80) |
| LC4 | 84.27 (72.23) | 135.24 (82.65) | 102.10 (129.40) | 82.54 (74.78) | 58.14 (20.48) | 126.16 (66.09) |
| LC5 | 86.52 (71.30) | 121.50 (75.47) | 81.68 (50.27) | 81.74 (49.83) | 75.14 (32.27) | 76.11 (39.10) |
| Ave. Duration and SD (ms) | 90.42 (70.13) | 129.12 (85.77) | 103.50 (108.31) | 87.59 (63.66) | 78.08 (49.35) | 103.34 (65.64) |

Ave. = Average
SD = Standard Deviation
*SD values are listed in parenthesis

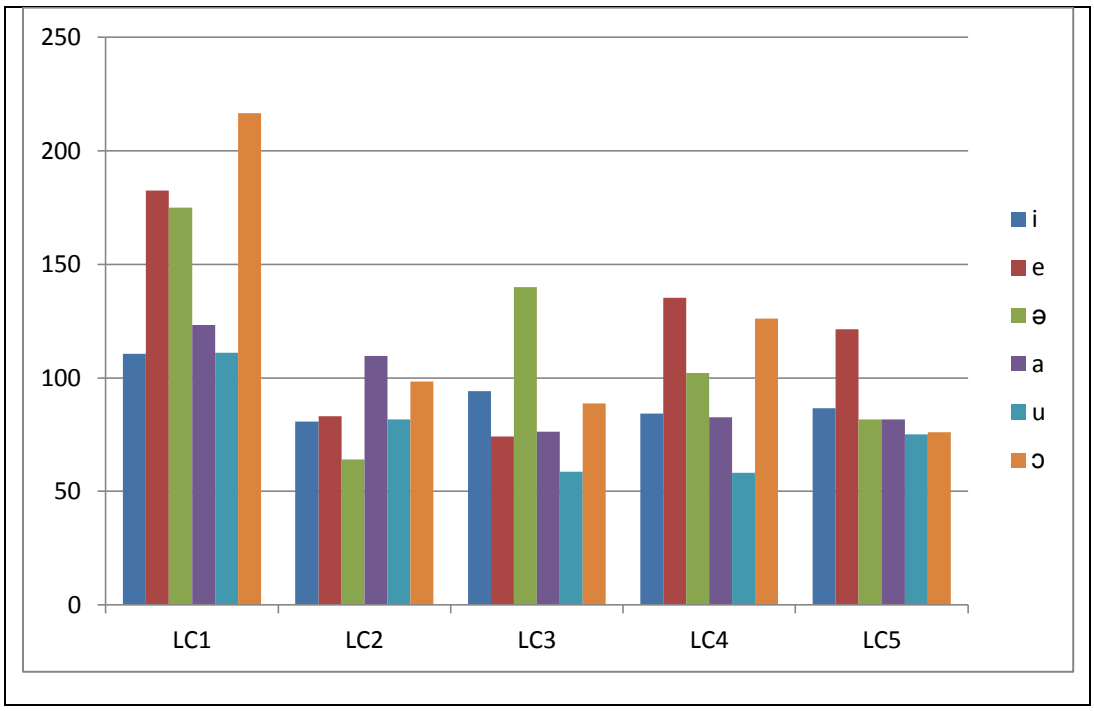

Figure 4.18: Histogram of MPC Vowel Durations

As can be seen in Table 4.17, there were no significant differences between the average duration of the five LCs for /i/ which indicates that they were produced with similar average durations. A one-way ANOVA on the /i/ vowel duration of each LC was performed and no significant differences were found among the mean durations of the five LCs, F (4, 118) = 0.64, p = 0.64. In other words, the /i/ vowel duration were produced with similar average duration among the five LCs.

For /e/, there were significant differences between the average duration of five LCs. A one-way ANOVA showed that there were significant differences between the mean durations of the five LCs, F (4, 177) = 7.12, p <.0001. Tukey post-hoc comparisons of the five LCs show that the means durations were significantly different between the LCs between LC1 (M = 182.54ms, SD = 111.94ms) and LC2 (M = 83.01ms, SD = 36.50ms), LC1 and LC3 (M = 74.28ms, SD = 29.01ms), LC1 and LC5 (M = 121.50ms, SD = 85.77ms), LC3 and LC4 (M = 135.24ms, SD = 82.65ms). In other words, this test

result echoes Figure 4.18 where each LC produced /e/ with considerable differences in mean vowel duration.

For /ə/, a one-way ANOVA showed that although the mean durations seems to be different from Figure 4.18, there were no significant differences among the mean durations of three LCs (LC2 and LC3 were removed from test for there were less than ten items in ), $F(2, 49) = 2.39$, $p = 0.102234$.

For /a/, significant differences were found among the mean durations of the five LCs, $F(4, 489) = 6.14$, $p < .0001$. Tukey post-hoc comparisons of the five LCs show that the mean durations were significantly different between between LC1 (M = 123.38ms, SD = 78.29ms) and LC3 (M = 76.25ms, SD = 50.44ms), LC1 and LC4 (M = 82.54ms, SD = 74.78ms), LC1 and LC5 (M = 81.74ms, SD = 49.83ms), LC2 (M = 109.75ms, SD = 50.60ms) and LC3.

For /u/, no significant differences were found among the mean durations four LCs (LC3 was excluded from test for there were less than ten tokens of /u/ in the selected data), $F(3, 108) = 3.82$, $p = 0.012$. Tukey post-hoc comparisons of the four LCs show that the mean durations were significantly different only between LC1 (M = 96.74ms, SD = 69.34ms) and LC4 (M = 58.14ms, SD = 20.48ms).

For /ɔ/, no significant differences among the mean durations of four LCs (LC1 was excluded from test for there were less than ten tokens of /ɔ/ in the selected data), F (3,

96) = 4.61, p = 0.005. Tukey post-hoc comparisons of the four LCs show that the mean durations were significantly different only between LC4 (M = 126.16ms, SD = 66.09ms) and LC5 (M = 76.11ms, SD = 39.10ms).

Since the durations of vowels can differ depending on whether they are in open or closed syllables, the vowel durations in each environment were examined to determine if there were differences when grouped by open or closed syllables. Table 4.18 shows the average vowel durations based on syllable type. The MPC /i/, /ə/, /a/, /u/ and /ɔ/ vowel durations are longer on average when they are in open syllables, except for /e/ which showed a reverse trend.

Table 4.18: Vowel Duration by Syllable Type

| Duration and SD (ms) | i | e | ə | a | u | ɔ |
|---|---|---|---|---|---|---|
| Open Syllable | 107.44 ( 83.76) | 121.60 (91.85) | 108.12 (112.71) | 88.90 (80.15) | 90.25 (68.35) | 112.77 (69.82) |
| Closed Syllable | 70.38 (43.70) | 144.04 (70.56) | 59.62 (25.43) | 86.56 (44.26) | 68.51 (23.73) | 102.88 (65.76) |

Ave. = Average
SD = Standard Deviation
*SD values are listed in parenthesis

To further investigate the durational patterns of /e/ vowel, an independent t-test was conducted but no significant differences were found for the mean of /e/ vowel in open and closed syllables: (t = 1.67, df = 180, p = 0.097, two-tailed, independent samples). Since there were no clear statistical differences the discussion will be made based on the histogram in Figure 4.19.

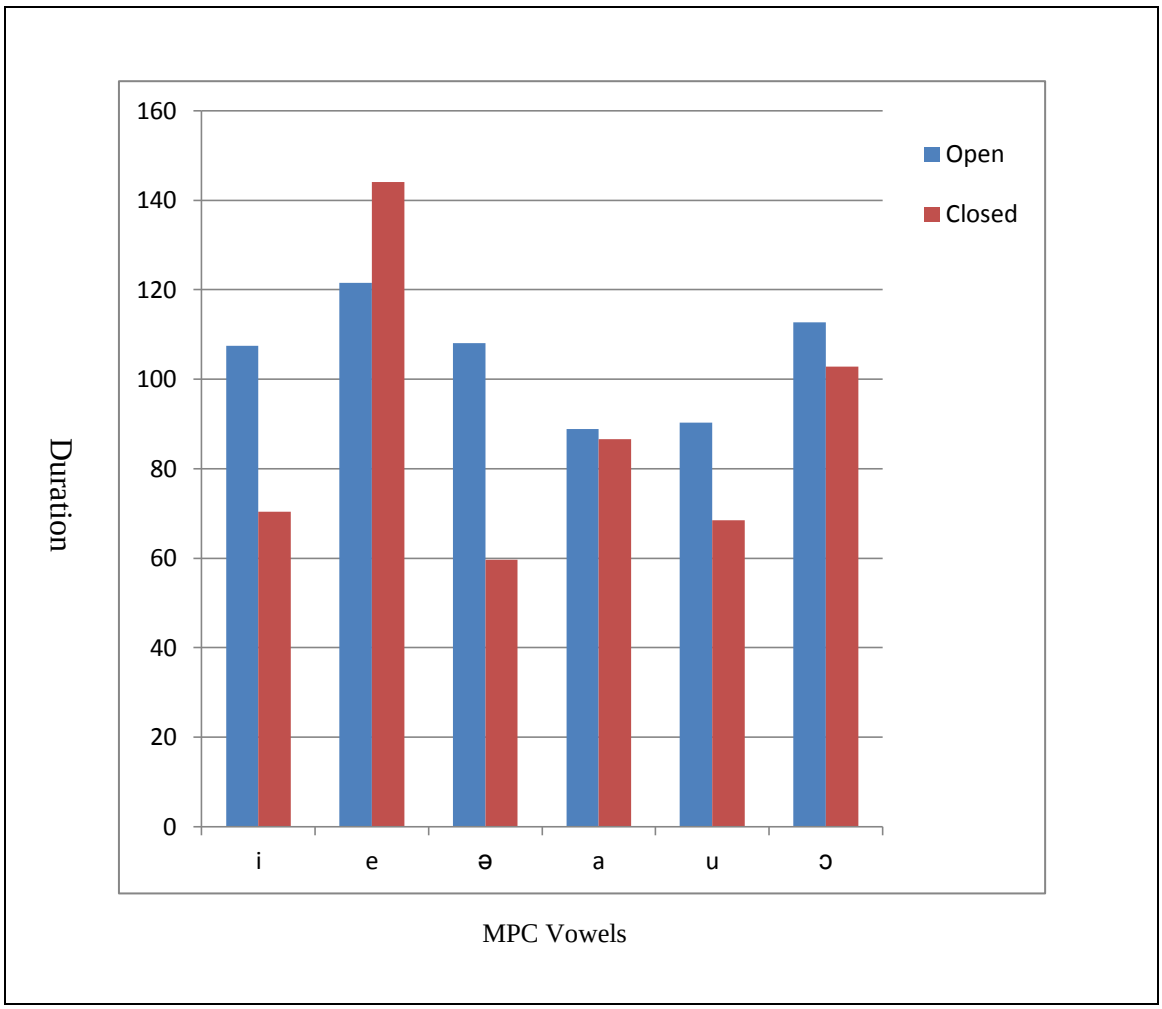


Figure 4.19: Histogram of MPC Vowel Duration by Syllable Types

It is interesting to note that /ə/ which occurs only as unstressed syllables has the longest average duration. This is because one of the characteristics of unstressed vowels is that it tends to appear shorter compared to stressed vowels. For example, in English /ə/ also only occurs in unstressed syllables and tends to be relatively short vowel.

## 4.4 Free Variation between /i/, /e/, /ɔ/ and /u/

Hancock (2009, p. 298) says that "[f]or some speakers there is a certain amount of free variation between /i/ and /e/, and /ɔ/ and /u/" (see 2.5), and in order to test this out a scatter plot with the four vowels was generated. Figure 4.20 indicates that the four vowels have a tendency to overlap with each other. However, there were significant differences between the F1 means of the /i/, /e/, /u/ and /ɔ/ four vowels, $F(3, 522) = 70.6$, $p < .0001$. Tukey post-hoc comparisons of the four vowels show that the F1 means were significantly different between the vowels except for between /i/ vowel (M = 451.2Hz, SD = 78Hz) and /u/ vowel (M = 461Hz, SD = 61.6Hz). Similarly, there were significant differences between the F2 means of the four vowels: $F(3, 522) = 259.3$, $p < .0001$). Tukey post-hoc comparisons of the four vowels show that the F1 means were significantly different between the vowels except for between /i/ vowel (M = 2201.3Hz, SD = 436.3Hz) and /e/ vowel (M = 2251.7Hz, SD = 389.8Hz). Thus, in terms of vowel height, we can expect fewer differences between /i/ and /e/ while in terms of vowel advancement, not much difference can be expected between /i/ and /e/. This is noticeable in Figure 4.20.

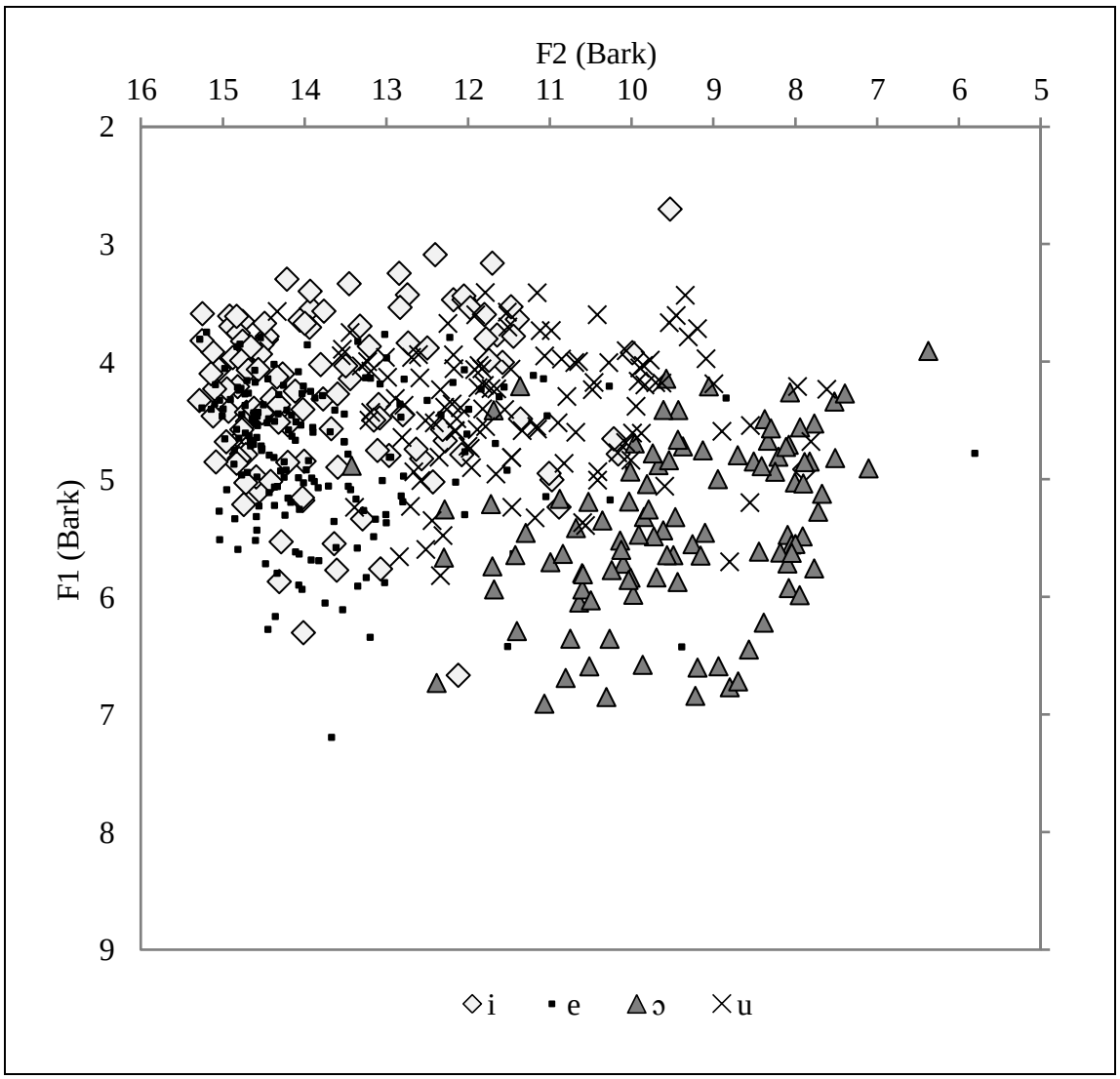


Figure 4.20: Scatter Plot of MPC /i/, /e/, /o/, /u/

To further examine the pairs of /i/ and /e/ and /ɔ/ and /u/, further scatter plots (see Figure 4.21 and Figure 4.22) were generated isolating these pairs. An independent t-test indicated a significant difference for the mean F1 values of /i/ and /e/: ($t = 6.41$, $df = 303$, $p < .0001$, two-tailed, independent samples). As F1 correlates to vowel height, the vowel height of /i/ and /e/ vowels can be said to be significantly different. However, no significant differences were found for the mean F2 values of /i/ and /e/: ($t = 1.05$, $df = 303$, $p = 0.2946$, two-tailed, independent samples). There is therefore a lack of contrast in relation to vowel fronting between these two vowels, and again this can be seen in Figure 4.21, and also in Figure 4.1. The insignificant difference in F2 may underlie the

tendency of free variation between these two vowels. However, no instances in the selected data where these vowels occurred in the same word were found.

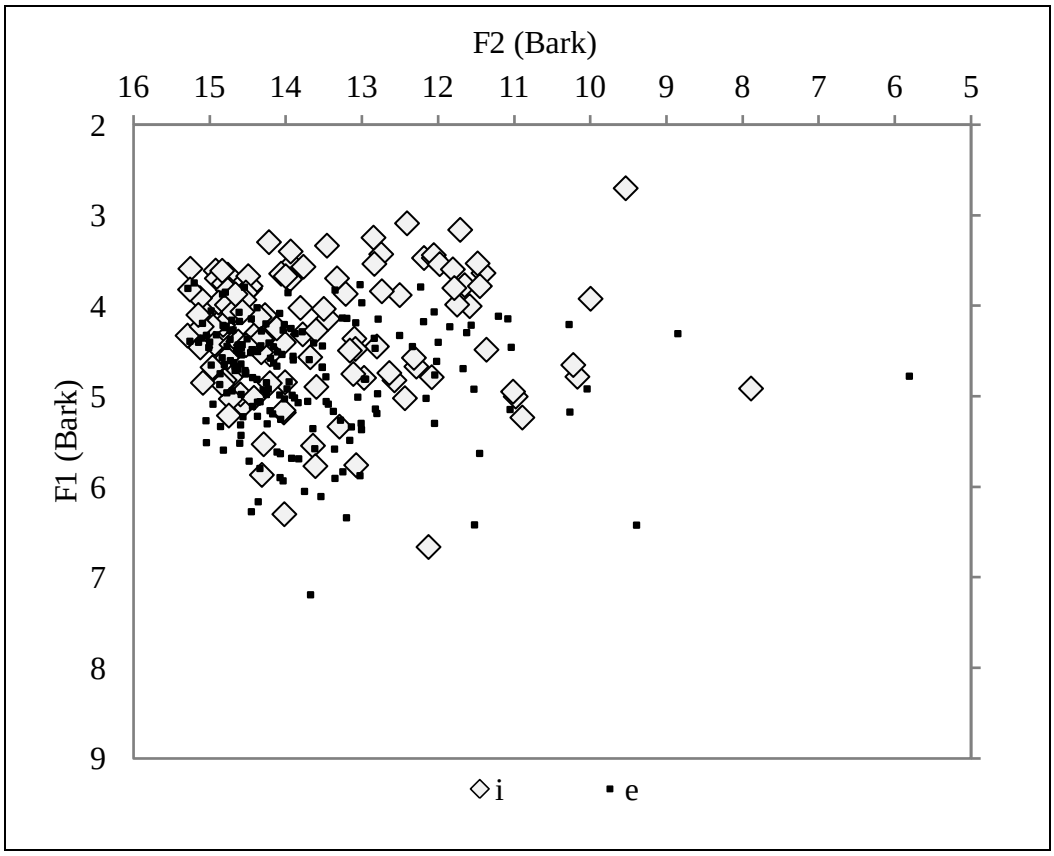


Figure 4.21: Scatter Plot of MPC /i/ and /e/

For the vowel pair /ɔ/ and /u/, significant differences were found for the mean F1 values of these vowels: ($t = 11.98$, $df = 219$, $p < .0001$, two-tailed, independent samples). As F1 correlates to vowel height, the vowel of /ɔ/ and /u/ vowels can be distinguished in terms of vowel height. Further there is also a contrast in terms of vowel fronting as there were significant differences between the mean F2 values of /ɔ/ and /u/: ($t = 9.68$, $df = 219$, $p < .0001$, two-tailed, independent samples). This contrast can be seen in Figure 4.22 and Figure 4.1. Thus, it does not appear as if there is free variation for this

vowel pair. Further, there were no instances in the selected data where these vowels occurred in the same word.

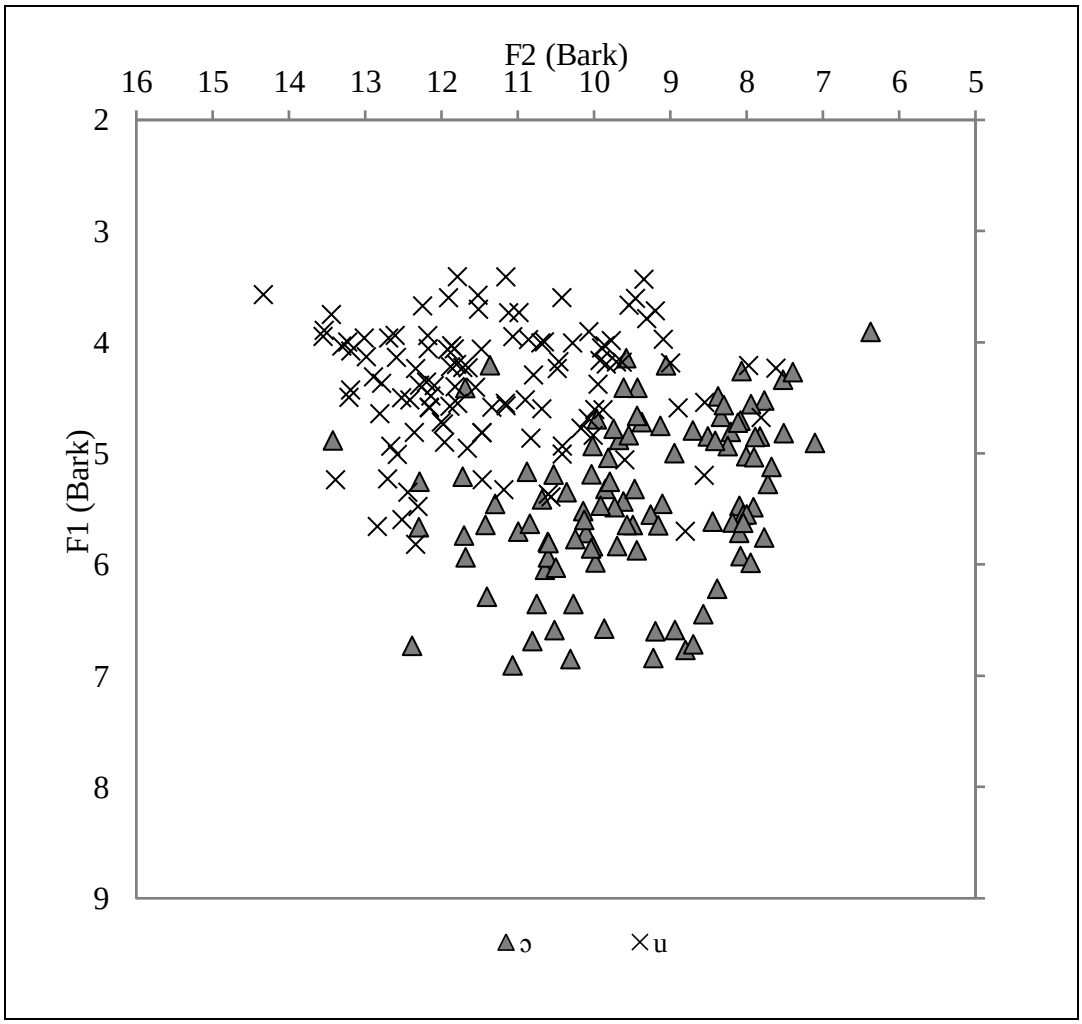


Figure 4.22: Scatter Plot of /ɔ/ and /u/

## 4.5 Comparison of MPC to Malay, Malaysian English and European Portuguese Monophthongs

As shown in Figure 4.1, /e/ is located high in the vowel chart relatively close to /i/. This is similar to what was found by Yusuf (2013) of Standard Malay (SM) (see 2.6.1). The difference with the SM vowels described by Yusuf (2013) lies in the back vowels, while as mentioned in the previous paragraph, in MPC, /u/ is relatively fronted in the vowel space whereas /o/ appears to be realised as /ɔ/. Based on the measurements presented by Yusuf (2013), the ED for both sets of vowels were compared since the speakers also speak Malay and MPC sounds are said to be close to Malay (see 2.6.1). However, the results of this comparison should be treated with caution as both sets of data were obtained in different speaking contexts and were produced by different speakers. However, such comparisons have been done by other researchers such as Deterding (2000). A comparison of the average ED values (see Table 4.19) of MPC vowels (1.70 Bark) indicates that they are less peripheral compared to SM (2.83 Bark, Yusuf, 2013, p. 274). Since the MPC speakers also speak Malaysian English (MalE), a comparison with the ED of MalE was done. The findings show that MPC vowels also tend to be less peripheral compared to MalE (2.86 Bark) (Pillai et al., 2010, p. 165). It should also be mentioned that the data for MalE and Malay were derived from word lists, and thus, we can expect the vowels to be more peripheral compared to data obtained from spontaneous speeches (e.g. Deterding, 2000). However, no significant difference was found between the ED values of SM and MPC vowels ($t = 3.3$ $df = 8$, $p = 0.01$, two-tailed, independent samples) which suggests that both sets of vowels are similarly spread out from the centre of the vowel space. Similarly, no significant differences were found between the ED values of MalE and MPC ($t = 2.750.07$, $df = 14$, $p = 0.95$, two-tailed, independent samples).

Considering that MPC is a Portuguese-based creole which originated from European Portuguese (EuPt), albeit from the 16th Century variety (see 2.6.3), a comparison of ED between EuPt and MPC was performed to ascertain how present day MPC vowels compared to present day EuPt. It should be noted, as mentioned in 2.2 and 2.6.3, that MPC which originated from sixteenth Century Portuguese is different from modern European Portuguese.

The comparison was based on Escudero and Boersma's (2009, p. 8) EuPt data of seven stressed vowels /i/, /e/, /ɛ/, /a/, /ɔ/, /o/and /u/. As predicted, the MPC vowels are less peripheral compared to those of EuPt (3.23 Bark). A significant difference was found between the ED values of EuPt and MPC ($t = 3.7$, $df = 9$, $p < 0.01$, two-tailed, independent samples). Although the data are not based on the same speakers and the same speaking contexts, it does appear that MPC, MalE and SM vowels are similarly placed less peripherally in the vowel space. This is not perhaps surprising considering that these three are all 'local' languages. In contrast, EuPt, is more peripheral, and thus spread out in the vowel space.

Table 4.19: F1 and F2 Values for MPC, SM*, MalE** and EuPt***

| | MPC | | MalE | | SM | | EuPt | |
|---|---|---|---|---|---|---|---|---|
| Vowels | Ave. F1 (Bark) | Ave. F2 (Bark) | Ave. F1 (Bark) | Ave. F2 (Bark) | Ave. F1 (Bark) | Ave. F2 (Bark) | Ave. F1 (Bark) | Ave. F2 (Bark) |
| i | 4.30 | 13.53 | 3.60 | 14.87 | 4.1 | 14.98 | 3.04 | 15.11 |
| e | 4.78 | 13.71 | 7.31 | 13.45 | 5.31 | 14.30 | 3.86 | 14.53 |
| ə* | 5.16 | 11.97 | 5.45 | 11.39 | 5.44 | 12.73 | 4.83 | 14.15 |
| a | 6.51 | 11.54 | 7.83 | 10.53 | 8.17 | 12.06 | 7.00 | 11.89 |
| u | 4.38 | 11.27 | 4.49 | 9.90 | 4.46 | 8.69 | 3.25 | 7.59 |
| o | 5.43 | 9.48 | 7.19 | 9.70 | 5.41 | 9.60 | 4.05 | 7.99 |
| iː | - | - | 3.07 | 15.26 | - | - | - | - |
| æ | - | - | 7.81 | 13.35 | - | - | - | - |
| ʌ | - | - | 7.64 | 10.83 | - | - | - | - |
| ɔː | - | - | 5.92 | 8.65 | - | - | 5.52 | 9.23 |
| uː | - | - | 3.94 | 8.68 | - | - | - | - |

MPC = Malacca Portuguese Creole
SM = Standard Malay
MalE = Malaysian English
EuPt = European Portuguese
Ave. = Average
* from Pillai et al (2010, p. 165)
** from Yusuf (2013, p. 274)
*** from Escudero and Boersma (2009, p. 8)

Figure 4.23 displays the vowels of MPC, SM, MalE and EuPt in a vowel quadrilateral. The /i/ vowels of MalE and EuPt are located at high front position where MPC /i/ is slightly lower and more back. SM and MPC /e/ are located nearby where MalE /e/ is located at a low front location. The /u/ vowels of SM and MPC are located at a high and central position, while EuPt /u/ vowel is located high back and further away from the centre. MPC /a/ is similar to those in SM and EuPt, which are located at a low central

position. MPC /o/ vowel is situated at mid height and further back than the equivalent vowel in SM and MalE, while being lower and more fronted than EuPt /o/.

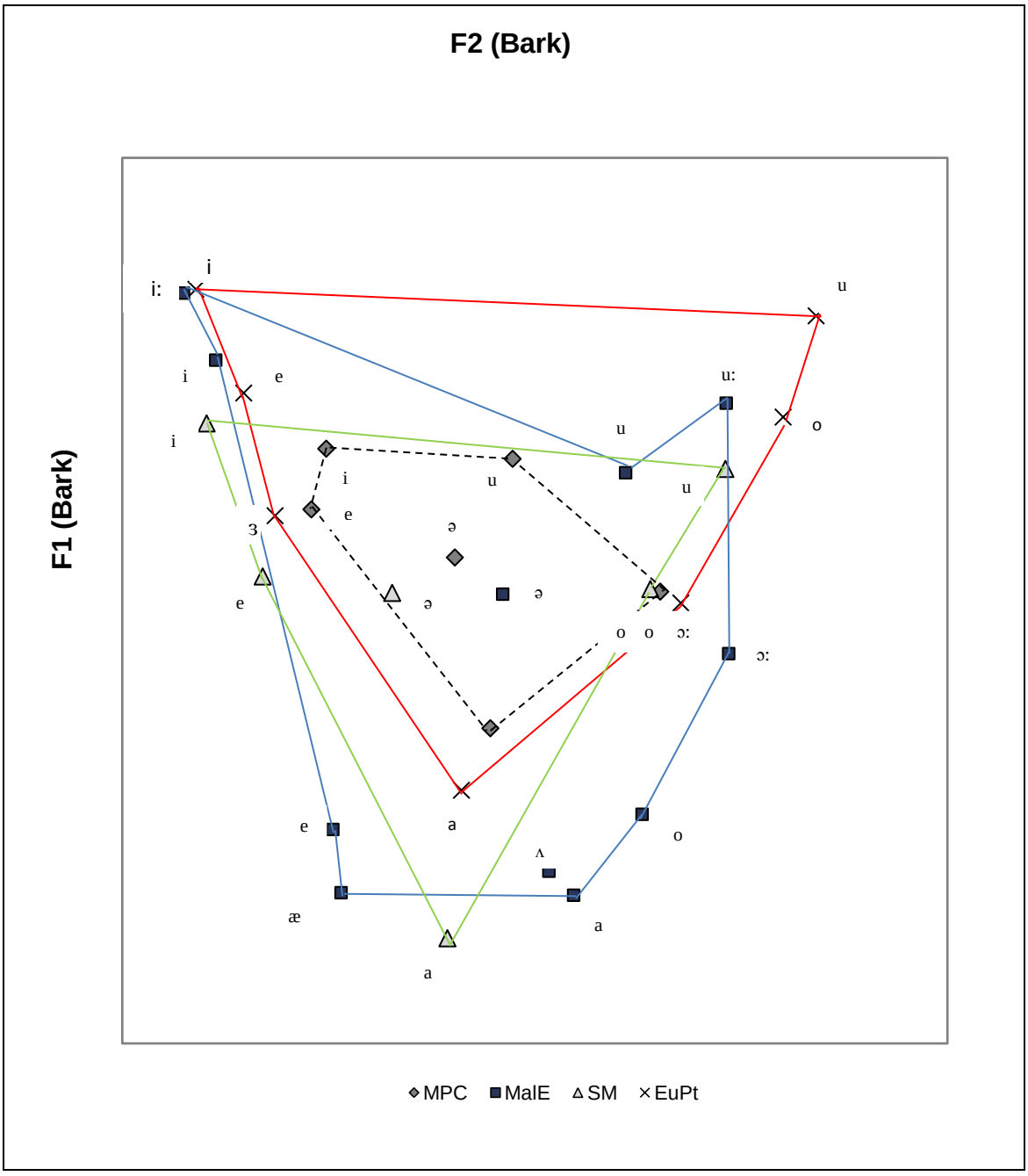


Figure 4.23: Vowels of MPC, SM, MalE and EuPt

MPC = Malacca Portuguese Creole
MalE = Malaysian English
SM = Standard Malay
EuPt = European Portuguese
* from Pillai et al (2010, p. 165)
** from Yusuf (2013, p. 274)
*** from Escudero and Boersma (2009, p. 8)

## 4. 6 Summary

The results of the selected data showed the presence of six MPC monophthongs. These were /i/, /e/, /ə/, /a/, /u/ and /ɔ/ which is similar to the monophthong inventory of Standard Malay's vowels. In terms of vowel dispersion in the vowel space, however, MPC is the least peripheral compared to two other local languages that the LCs speak, SM and MalE. Contrary to what has been reported previously (Klein 2006; Baxter 1988), no concrete evidence of a high back /o/ and low front /ɛ/, not even as an allophonic distinction was found. Similarly, Baxter's (1988, p. 26) contention that there is an /e/ - /ɛ/ and /o/-/ɔ/ distinction in some words in the same phonetic environment (e.g. pre /t/, /s/ and /z/) could not be verified by the selected data. Instead for /o/, there may be a height distinction before /t/ and /d but this warrants further investigation. Further, where /o/ is concerned, there may be a possibility of there being an o/-/ɔ/ distinction due to vowel harmony as suggested by Baxter (1988, p. 26) but again this needs to be examined further. Syllable type did not appear to influence vowel quality in all cases.

The following chapter will summarise the findings in relation to the research questions.

# CHAPTER 5

# CONCLUSION

## 5.1 Introduction

This chapter summarises the salient findings from this study in relation to the research questions. As outlined in Chapter 1, this study aimed to examine the characteristics of MPC monophthongs based on their acoustic properties and to compare these with the descriptions of these vowels in previous studies. This chapter will also discuss the limitations of the current study and suggest directions for future research.

## 5.2 Summary of Salient Findings

The findings are separated into three sections, each with its discussions as followed.

### 5.2.1 Research Question 1:

What are the characteristics of monophthong vowels in Malacca Portuguese Creole based on their acoustic properties?

Six MPC monophthong vowels emerged from the analysis: /i/, /e/, /ə/, /a/, /ɔ/ and /u/. This vowel inventory is similar to that of Malay. The two high front vowels, /i/ and /e/ were placed relatively close to each other (see Figure 4.1), and there was considerable overlap between these two vowels (see Figure 4.21), which may indicate that they are being used interchangeably by some MPC LCs. The vowel /u/ was more fronted in the vowel space compared to /ɔ/, while there was clear evidence of /ə/ and a centrally

placed /a/ in the data. The vowel /ɔ/ appeared to be placed more centrally back in the vowel space. In general, there was considerable variation in the way that the five LCs produced each of the vowels. There were also significant differences in the way that each LC produced each of the six vowels. This may be indicative of the endangered nature of MPC. As the use of MPC declines even in a contained area like the Portuguese Settlement, its pronunciation along with other linguistic features may be beginning to show signs of instability (see also Baxter, 2005). Further, syllable type (e.g. CV, CVC, CCV) did not appear to have an effect on the quality of the MPC vowels.

### 5.2.2 Research Question 2:

To what extent are the MPC monophthong vowels found in this study similar to those described in the literature?

Unlike previous studies (e.g. Baxter, 1988; Klein, 2006) there was no immediate evidence of a high back /o/ and low front /ɛ/ in the data, not even as an allophonic variation of /ɔ/ and /e/, thus reducing the vowel inventory of MPC to six rather than eight vowels. Klein (2006) and Baxter (1988) describe /o/ as a high back vowel but based on the formant values in this study, the LCs seemed to produce a low back /ɔ/. The vowel /u/ was relatively more fronted in this study whilst Baxter (1988) presents it as a high back vowel.

No further evidence of there being any systematic contrast between /e/ and /ɛ/ as suggested by Baxter (1988, p. 26) were found in the data. Further no conclusive evidence was found regarding Baxter's (1988) contention that the distribution of /e/ - /ɛ/ is a result of vowel harmony. Similarly, no systematic difference was found for a /o/ - /ɔ/ distinction in the data. However, in terms of vowel harmony there was some

indication in the data that /ɔ/ tended to be produced higher when it was followed by high vowels while the reverse occurred when it was followed by a low vowel in the following syllable.

Based on Hancock's (2009) view that that there is free variation between /i/ and /e/ and /o/ and /u/, there is a possibility that this is true for /i/ and /e/ but not for the latter pair. As was mentioned previously, there were considerable overlaps between the /i/ and /e/ vowels produced by the speakers.

### 5.2.3 Research Question 3:

How do the MPC monophthong vowels compare to similar vowels in Malay, Malaysian English and European Portuguese?

Based on the Euclidean Distances for MPC, Malay, Malaysian English (MalE) and European Portuguese (EuPt), it appears that MPC, Malay and MalE vowels are similarly placed less peripherally in the vowel space (see Figure 4.2). Despite MalE and Malay being taken from different speakers and from more formal speaking contexts, their less peripheral nature shows some similarity in the way that the vowels are placed in the vowel space for these three are 'local' languages, which are also spoken by the LCs. In contrast, EuPt, is more spread out in the vowel space.

For vowels which occur in all these languages, no concrete pattern of similarity was found with MPC. For example the /i/ of MalE and EuPt were both located at a high front position in the vowel space whereas MPC /i/ was slightly lower and back. SM and MPC /e/ appear to be produced similarly as are /u/ and /a/ in these two languages. This suggests that the quality of MPC vowels may be closer to that of Malay vowels, which is perhaps not surprising given that Malay, in particular Bazaar Malay, would have been

the main contact language for MPC from the sixteenth Century, and especially upon the withdrawal of the Portuguese from Malacca. The reduced vowel inventory of MPC compared to current day EuPT is one of the features of MPC as a Portuguese-based Creole.

## 5.3 Limitations

This study was based on data selected from recordings of interviews of five female native speakers of MPC. Thus, there are limitations in terms of sample size, the selection of the LCs and gender. As mentioned in Chapter 3, the limitations with regards to the first two items are related to the endangered status of MPC, where there are not many fluent speakers of the language left. Further, this study is only based on one aspect of MPC pronunciation, the production of MPC monophthongs. Another limitation is that the data were selected from spontaneous speech. This meant that there was no control over how many target vowels were obtained within the criteria applied. As MPC is an oral language, the use of read text was not deemed suitable for data elicitation. This, and the other limitations, has to be borne in mind in the interpretation of the findings.

## 5.4 Future Directions

The findings from this study suggest some degree of instability in the way that the monophthongs are being pronounced. For instance there is considerable within and among speaker variability in vowel quality. More detailed examinations of more speakers should be conducted to determine if this variation is indeed a current trend and if it is related to language loss. It is also suggested that speakers from different age groups, are included in such a study. Such a study will show differences in

pronunciation not just between age groups but between more fluent and not so fluent speakers (especially among the younger group). Future research may also want to consider alternative data elicitation methods such as using word cards to elicit target words which may provide more control over the number of tokens obtained.

Further, a more systematic investigation of the existence of the /e/ - /ɛ/ and /o/ - /ɔ/ is also needed to confirm the descriptions by Baxter (1988). Future studies also need to extend examine the quality of other sounds in MPC, including its prosodic features such as lexical stress placement. More systematic comparisons with the acoustic characteristics of Malay sounds should also be carried out to determine the extent of Malay influence on MPC as this could also contribute to decisions about the orthographic representation of MPC.

## 5.5 Conclusion

The findings from this study contribute to our understanding of MPC sounds and add to the mostly impressionistic descriptions of its sound system. The findings from this study suggest several areas that need further investigation so that a more systematic description of MPC sounds can be made. Such descriptions can then be used to inform related work on MPC such as the spelling system, dictionaries and documentation efforts. All these are essential to help keep MPC alive.

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## APPENDIX A - Interview Questions

| | |
|---|---|
| Ki bosa nomi? | What is your name? |
| Bos Kantu Idade? | How old are you? |
| Uni bos ta fika? | Where did you grow up? |
| Ki bos papia na kaza kore bos kenino? | Which language was spoken at home when you were a child? |
| Kore bos japrende papia kristang/ MPC? | When and how did you learn MPC? |
| Ki mas bos papia? | Which other language do you speak? |
| Ki bos japrende na skola/ university? | Which course did you study at school/ university? |
| Ki skola bos jabai kore bos kenino? | Which type of primary school did you attend ? |
| Ki bos fai sibrisu? | What is your occupation? |
| Uni bos fai sibrisu? | Where do you work? |

## APPENDIX B1 - MPC /i/

| No | /i/ | Word | Meaning | Time | Duration | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | LC1 | fIkah | stay | 33.746129 | 0.0316 | 384 | 2070 | 3.70 | 13.3 |
| 2 | LC1 | akIh | here | 65.941003 | 0.2293 | 372 | 2827 | 3.59 | 15.3 |
| 3 | LC1 | fIkah | stay | 99.3754 | 0.0881 | 367 | 2274 | 3.55 | 13.9 |
| 4 | LC1 | jentIbeng | people come | 184.062192 | 0.0321 | 481 | 2187 | 4.57 | 13.7 |
| 5 | LC1 | jentIbeng | people come | 186.39935 | 0.0214 | 277 | 1170 | 2.70 | 9.5 |
| 6 | LC1 | jentIteng | people have | 192.427467 | 0.0642 | 374 | 2675 | 3.61 | 14.9 |
| 7 | LC1 | bintItres | twenty three | 195.510927 | 0.0862 | 384 | 2668 | 3.70 | 14.9 |
| 8 | LC1 | bintinovIku | Twenty nine with | 208.185731 | 0.1395 | 355 | 1893 | 3.43 | 12.7 |
| 9 | LC1 | bintItres | twenty three | 209.976962 | 0.0674 | 379 | 2605 | 3.66 | 14.8 |
| 10 | LC1 | bintItres | twenty three | 211.273414 | 0.0463 | 396 | 2484 | 3.81 | 14.5 |
| 11 | LC1 | dIbazar | at bazaar | 238.031955 | 0.0561 | 390 | 2628 | 3.76 | 14.8 |
| 12 | LC1 | kukIs | cookies | 242.528575 | 0.1100 | 424 | 2733 | 4.06 | 15.1 |
| 13 | LC1 | kukIs | cookies | 245.847371 | 0.2220 | 454 | 2845 | 4.33 | 15.3 |
| 14 | LC1 | kukIs | cookies | 262.930394 | 0.1459 | 440 | 2631 | 4.21 | 14.8 |
| 15 | LC1 | nakIh | here | 288.60254 | 0.0977 | 443 | 2689 | 4.23 | 15.0 |
| 16 | LC1 | padIkumih | return to eat | 315.483131 | 0.2170 | 398 | 2605 | 3.82 | 14.8 |
| 17 | LC1 | anutI | at night | 316.674141 | 0.0326 | 318 | 1797 | 3.09 | 12.4 |
| 18 | LC1 | portugIs | portuguese | 338.641562 | 0.1474 | 413 | 2658 | 3.96 | 14.9 |
| 19 | LC1 | portugIs | portuguese | 340.024715 | 0.1325 | 408 | 2768 | 3.92 | 15.1 |
| 20 | LC1 | kukIs | cookies | 340.867852 | 0.1643 | 397 | 2829 | 3.82 | 15.3 |
| 21 | LC1 | pesI | fish | 378.503539 | 0.0731 | 464 | 2680 | 4.42 | 14.9 |
| 22 | LC1 | bontadI | wish | 449.100603 | 0.0831 | 491 | 2615 | 4.65 | 14.8 |
| 23* | LC1 | nakIh | here | 501.46125 | 0.2546 | 408 | 1254 | 3.92 | 10.0 |
| 24 | LC2 | fIkah | stay | 27.332966 | 0.0632 | 351 | 2279 | 3.40 | 13.9 |
| 25 | LC2 | chIku | name Chiku | 28.959513 | 0.0432 | 335 | 1922 | 3.25 | 12.8 |
| 26 | LC2 | sIbrisu | work | 37.661224 | 0.0480 | 359 | 1738 | 3.47 | 12.2 |
| 27 | LC2 | fIku | banana | 209.34476 | 0.0961 | 340 | 2385 | 3.30 | 14.2 |
| 28 | LC2 | mortIchina | chinese funeral | 219.738466 | 0.0417 | 344 | 2113 | 3.34 | 13.5 |
| 29 | LC2 | antIdi | before of | 223.514287 | 0.0417 | 366 | 1919 | 3.54 | 12.8 |
| 30 | LC2 | jentI | people | 231.94084 | 0.0608 | 385 | 2281 | 3.71 | 13.9 |
| 31 | LC2 | dI | of | 232.096553 | 0.0868 | 326 | 1618 | 3.16 | 11.7 |
| 32 | LC2 | jentI | people | 275.875931 | 0.0455 | 359 | 1704 | 3.47 | 12.1 |
| 33 | LC2 | isI | this | 297.247491 | 0.1612 | 378 | 2324 | 3.65 | 14.1 |
| 34 | LC2 | jinjIbri | ginger | 333.496461 | 0.1588 | 356 | 1704 | 3.44 | 12.1 |
| 35 | LC2 | podI | can | 363.784612 | 0.1227 | 462 | 2311 | 4.41 | 14.0 |
| 36 | LC3 | fIkah | stay | 128.804721 | 0.0405 | 506 | 1711 | 4.79 | 12.1 |
| 37 | LC3 | bIziah | visit | 275.735902 | 0.1048 | 404 | 1824 | 3.88 | 12.5 |
| 38 | LC3 | bIziah | visit | 285.276588 | 0.1017 | 507 | 1959 | 4.80 | 13.0 |
| 39 | LC3 | bIziah | visit | 291.716499 | 0.0384 | 635 | 2421 | 5.87 | 14.3 |
| 40 | LC3 | nakIh | here | 356.939593 | 0.0292 | 689 | 2309 | 6.30 | 14.0 |
| 41 | LC3 | nakIh | here | 379.380044 | 0.2874 | 513 | 2305 | 4.85 | 14.0 |
| 42 | LC3 | sIbrisu | work | 398.897876 | 0.0280 | 514 | 2381 | 4.85 | 14.2 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 43 | LC3 | fIkah | stay | 443.957155 | 0.0415 | 467 | 1909 | 4.45 | 12.8 |
| 44 | LC3 | nakIh | here | 448.536658 | 0.0480 | 595 | 2175 | 5.55 | 13.6 |
| 45 | LC3 | sIbrisu | work | 479.076255 | 0.0608 | 542 | 2519 | 5.10 | 14.6 |
| 46 | LC3 | nakIh | here | 698.568075 | 0.2401 | 521 | 906 | 4.91 | 7.9 |
| 47 | LC3 | nakIh | here | 713.054656 | 0.1345 | 505 | 2611 | 4.78 | 14.8 |
| 48 | LC3 | fIkah | stay | 824.857498 | 0.0694 | 370 | 2219 | 3.57 | 13.8 |
| 49 | LC4 | dIsnovi | nineteen | 100.216856 | 0.1699 | 393 | 2480 | 3.78 | 14.5 |
| 50 | LC4 | fIkah | stay | 113.165045 | 0.0525 | 552 | 2311 | 5.18 | 14.0 |
| 51 | LC4 | nakIh | here | 122.446378 | 0.0915 | 465 | 2585 | 4.43 | 14.7 |
| 52 | LC4 | dIkeninu | was young | 137.792336 | 0.0553 | 474 | 2579 | 4.51 | 14.7 |
| 53 | LC4 | fIkah | stay | 246.415371 | 0.0534 | 433 | 2109 | 4.14 | 13.4 |
| 54 | LC4 | nakIh | here | 256.416702 | 0.1425 | 381 | 2493 | 3.67 | 14.5 |
| 55 | LC4 | fIkah | stay | 259.24606 | 0.0554 | 375 | 2637 | 3.61 | 14.8 |
| 56 | LC4 | fIkah | stay | 260.322009 | 0.0304 | 428 | 2405 | 4.10 | 14.3 |
| 57 | LC4 | nakIh | here | 270.601209 | 0.1012 | 452 | 2222 | 4.32 | 13.8 |
| 58 | LC4 | fIkah | stay | 271.406118 | 0.0405 | 477 | 2380 | 4.54 | 14.2 |
| 59 | LC4 | sIbrisu | work | 300.950308 | 0.0388 | 452 | 2455 | 4.32 | 14.4 |
| 60 | LC4 | sIbrisu | work | 303.025062 | 0.0639 | 736 | 1722 | 6.67 | 12.1 |
| 61 | LC4 | nakIh | here | 404.548557 | 0.0315 | 528 | 2535 | 4.98 | 14.6 |
| 62 | LC4 | nakIh | here | 422.131111 | 0.2082 | 466 | 2552 | 4.44 | 14.6 |
| 63 | LC4 | nakIh | here | 480.773405 | 0.0491 | 506 | 2589 | 4.79 | 14.7 |
| 64 | LC4 | kI | what? | 484.736581 | 0.1512 | 510 | 2623 | 4.82 | 14.8 |
| 65 | LC4 | akIh | here | 505.053289 | 0.1055 | 534 | 2588 | 5.03 | 14.7 |
| 66 | LC4 | sIbrisu | work | 543.762056 | 0.0419 | 405 | 2525 | 3.89 | 14.6 |
| 67 | LC4 | butIka | shop | 558.979547 | 0.0749 | 443 | 2757 | 4.23 | 15.1 |
| 68 | LC4 | nakIh | here | 560.029444 | 0.1859 | 515 | 2637 | 4.86 | 14.8 |
| 69 | LC4 | butIka | shop | 580.903196 | 0.0289 | 475 | 2425 | 4.51 | 14.3 |
| 70 | LC4 | fIkah | stay | 592.509782 | 0.0343 | 458 | 1998 | 4.36 | 13.1 |
| 71 | LC4 | fIkah | stay | 597.530780 | 0.0539 | 431 | 2433 | 4.13 | 14.3 |
| 72 | LC4 | bIziah | look after | 598.748593 | 0.1075 | 416 | 2610 | 3.99 | 14.8 |
| 73 | LC4 | nakIh | here | 644.311146 | 0.0475 | 428 | 2778 | 4.10 | 15.1 |
| 74 | LC4 | subIh | go to (sea) | 647.509827 | 0.0782 | 425 | 2575 | 4.07 | 14.7 |
| 75 | LC4 | dIferenti | different | 715.574109 | 0.0551 | 421 | 2127 | 4.03 | 13.5 |
| 76 | LC4 | kI | which | 757.457328 | 0.0629 | 445 | 2346 | 4.25 | 14.1 |
| 77 | LC4 | sortI | kind/ type | 778.399246 | 0.0490 | 533 | 1805 | 5.02 | 12.4 |
| 78 | LC4 | dIporku | of the pork | 782.143216 | 0.0450 | 470 | 1994 | 4.48 | 13.1 |
| 79 | LC4 | sortI | kind/ type | 826.271166 | 0.1074 | 556 | 2599 | 5.21 | 14.7 |
| 80 | LC4 | dI | to / at | 833.336216 | 0.2625 | 482 | 2609 | 4.58 | 14.8 |
| 81 | LC4 | fIkah | stay | 839.251425 | 0.0424 | 401 | 2506 | 3.85 | 14.5 |
| 82 | LC4 | fIkah | stay | 841.992218 | 0.0420 | 410 | 2513 | 3.93 | 14.5 |
| 83 | LC4 | sortI | kind/ type | 864.707339 | 0.0312 | 424 | 2524 | 4.07 | 14.6 |
| 84 | LC4 | pIdih | request | 890.984653 | 0.0662 | 458 | 2424 | 4.37 | 14.3 |
| 85 | LC4 | pidIh | request | 891.210142 | 0.2524 | 518 | 2160 | 4.90 | 13.6 |
| 86 | LC4 | mistI | must | 898.329928 | 0.0248 | 447 | 2161 | 4.27 | 13.6 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 87 | LC4 | sortI | kind/ type | 900.455067 | 0.0438 | 472 | 2016 | 4.50 | 13.2 |
| 88 | LC4 | pIdih | request | 903.181134 | 0.0606 | 461 | 2547 | 4.40 | 14.6 |
| 89 | LC4 | pidIh | request | 903.285622 | 0.0761 | 469 | 2766 | 4.46 | 15.1 |
| 90 | LC4 | kI | what? | 904.625371 | 0.0247 | 466 | 2505 | 4.43 | 14.5 |
| 91 | LC4 | podI | can | 908.301253 | 0.3732 | 494 | 2693 | 4.68 | 15.0 |
| 92 | LC4 | sortI | kind/ type | 910.432002 | 0.0732 | 513 | 2750 | 4.85 | 15.1 |
| 93 | LC4 | mistI | must | 937.468926 | 0.0600 | 533 | 2463 | 5.02 | 14.4 |
| 94 | LC4 | mistI | must | 938.752317 | 0.0302 | 549 | 2313 | 5.16 | 14.0 |
| 95 | LC5 | fIkah | stay | 52.520377 | 0.0469 | 366 | 1685 | 3.54 | 12.0 |
| 96 | LC5 | sIbrisu | work | 67.364455 | 0.0498 | 417 | 1588 | 4.00 | 11.6 |
| 97 | LC5 | nakIh | here | 74.534151 | 0.2563 | 377 | 1546 | 3.64 | 11.4 |
| 98 | LC5 | dIses | sixteen | 113.101566 | 0.0879 | 373 | 1642 | 3.60 | 11.8 |
| 99 | LC5 | fIkah | stay | 193.788242 | 0.0438 | 381 | 2302 | 3.67 | 14.0 |
| 100 | LC5 | sIbrisu | work | 199.51196 | 0.1013 | 493 | 1764 | 4.67 | 12.3 |
| 101 | LC5 | skIseh | forgotten | 269.45949 | 0.0519 | 558 | 1433 | 5.24 | 10.9 |
| 102 | LC5 | fIkah | stay | 375.88857 | 0.0348 | 403 | 2562 | 3.87 | 14.7 |
| 103 | LC5 | fIkah | stay | 1453.14145 | 0.0590 | 402 | 2034 | 3.87 | 13.2 |
| 104 | LC5 | fIkah | stay | 388.750448 | 0.0188 | 502 | 2002 | 4.75 | 13.1 |
| 105 | LC5 | nakIh | here | 411.226873 | 0.2459 | 593 | 2412 | 5.53 | 14.3 |
| 106 | LC5 | fIkah | stay | 464.88757 | 0.0290 | 399 | 1890 | 3.84 | 12.7 |
| 107 | LC5 | kI | which | 480.723413 | 0.0910 | 570 | 2060 | 5.34 | 13.3 |
| 108 | LC5 | fIkah | stay | 486.705044 | 0.0408 | 531 | 1452 | 5.00 | 11.0 |
| 109 | LC5 | sIbrisu | work | 550.603821 | 0.0539 | 392 | 1604 | 3.77 | 11.6 |
| 110 | LC5 | butIka | shop | 553.891675 | 0.1124 | 366 | 1564 | 3.53 | 11.5 |
| 111 | LC5 | butIka | shop | 577.931569 | 0.0326 | 416 | 1628 | 3.99 | 11.7 |
| 112 | LC5 | ubIh | listen to | 663.537494 | 0.1464 | 525 | 1459 | 4.95 | 11.0 |
| 113 | LC5 | fIkah | stay | 722.845857 | 0.0114 | 510 | 1843 | 4.82 | 12.6 |
| 114 | LC5 | sIbrisu | work | 789.626378 | 0.0654 | 501 | 1862 | 4.74 | 12.6 |
| 115 | LC5 | butIka | shop | 814.664928 | 0.1052 | 505 | 1287 | 4.78 | 10.2 |
| 116 | LC5 | fIkah | stay | 850.597144 | 0.0390 | 471 | 1537 | 4.49 | 11.4 |
| 117 | LC5 | sIbrisu | work | 873.340582 | 0.0537 | 393 | 1557 | 3.78 | 11.4 |
| 118 | LC5 | nakIh | here | 891.658692 | 0.2982 | 395 | 1637 | 3.80 | 11.8 |
| 119 | LC5 | frizIh | fried | 1001.383508 | 0.0821 | 491 | 1297 | 4.66 | 10.2 |
| 120* | LC5 | kuzIdu | cooking | 1013.113724 | 0.1362 | 420 | 2232 | 4.02 | 13.8 |
| 121 | LC5 | frizIh | fried | 1019.148773 | 0.1094 | 622 | 1991 | 5.76 | 13.1 |
| 122 | LC5 | frizIh | fried | 1046.632998 | 0.0389 | 482 | 1773 | 4.58 | 12.3 |
| 123 | LC5 | frizIh | fried | 1047.391171 | 0.0670 | 623 | 2164 | 5.77 | 13.6 |
| | Ave | | | | 0.09042 | 451 | 2201 | 4.295 | 13.54 |
| | SD | | | | 0.07013 | 78 | 436 | 0.68 | 1.43 |

## APPENDIX B2 - MPC /e/

| No | /e/ | Word | Meaning | Time | Duration | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | LC1 | mbEs | also | 44.365718 | 0.119196897782807 | 441 | 2632 | 4.22 | 14.82 |
| 2 | LC1 | mbEs | also | 45.628369 | 0.436663414447075 | 433 | 2476 | 4.15 | 14.45 |
| 3 | LC1 | prendEh | learn | 78.256256 | 0.141928228568077 | 478 | 2528 | 4.54 | 14.58 |
| 4 | LC1 | sabEh | know | 119.34158 | 0.093983795 7275245 | 425 | 2542 | 4.07 | 14.61 |
| 5 | LC1 | sandEh | light up | 151.756529 | 0.183055158437242 | 447 | 2575 | 4.27 | 14.69 |
| 6 | LC1 | bendEh | sell | 164.617714 | 0.212676195831676 | 394 | 2513 | 3.79 | 14.54 |
| 7 | LC1 | fEstival | festival | 183.777451 | 0.113860954787896 | 631 | 2045 | 5.83 | 13.25 |
| 8 | LC1 | fEstival | festival | 186.195316 | 0.101799234474328 | 539 | 2243 | 5.07 | 13.84 |
| 9 | LC1 | pEdru | peter | 204.395634 | 0.105366031460591 | 466 | 2426 | 4.44 | 14.33 |
| 10 | LC1 | sandEh | light up | 212.741251 | 0.047513814 0479032 | 524 | 2580 | 4.94 | 14.70 |
| 11 | LC1 | sEdu | early | 227.974688 | 0.144259835527009 | 458 | 2592 | 4.37 | 14.73 |
| 12 | LC1 | fazEh | do | 241.446058 | 0.181356365342936 | 436 | 2540 | 4.17 | 14.61 |
| 13 | LC1 | bendEh | sell | 249.068283 | 0.134573202396382 | 526 | 2610 | 4.96 | 14.77 |
| 14 | LC1 | sampEh | until | 263.589665 | 0.226262564203012 | 485 | 2591 | 4.61 | 14.73 |
| 15 | LC1 | sampEh | until | 270.67194 | 0.349823622085808 | 490 | 2625 | 4.65 | 14.81 |
| 16 | LC1 | fazEh | do | 330.715092 | 0.138770317468527 | 465 | 2527 | 4.43 | 14.58 |
| 17 | LC1 | akEh | these | 331.366778 | 0.274806754049337 | 498 | 2510 | 4.72 | 14.53 |
| 18 | LC1 | ondE | kueh | 344.943604 | 0.333740884124154 | 462 | 2710 | 4.40 | 15.00 |
| 19 | LC1 | fazEh | do | 354.566005 | 0.173647325 54546 | 502 | 2508 | 4.75 | 14.53 |
| 20 | LC1 | fazEh | do | 357.865015 | 0.077366340755475 | 463 | 2385 | 4.41 | 14.22 |
| 21 | LC1 | pEsi | fish | 378.263976 | 0.130466119462142 | 423 | 2701 | 4.06 | 14.98 |
| 22 | LC1 | mbEs | also | 383.530357 | 0.136855738894269 | 447 | 2593 | 4.27 | 14.73 |
| 23 | LC1 | bEbeh | drink | 399.368009 | 0.126755608312919 | 465 | 2526 | 4.43 | 14.57 |
| 24 | LC1 | bEbeh | drink | 402.087951 | 0.089815201 3547815 | 474 | 2444 | 4.51 | 14.37 |
| 25 | LC1 | bebEh | drink | 402.496396 | 0.526060465 07799 | 453 | 2670 | 4.32 | 14.91 |
| 26 | LC1 | bEbeh | drink | 403.212723 | 0.062239613 6445786 | 458 | 2499 | 4.37 | 14.51 |
| 27 | LC1 | bebEh | drink | 403.492801 | 0.334537923339838 | 467 | 2610 | 4.45 | 14.77 |
| 28 | LC1 | prendEh | learn | 455.66226 | 0.261141598889196 | 444 | 2624 | 4.24 | 14.80 |
| 29 | LC1 | prendEh | learn | 506.555722 | 0.104697733219382 | 453 | 2729 | 4.33 | 15.04 |
| 30 | LC1 | dEsa | give/ allow | 541.806728 | 0.107644908333668 | 533 | 2260 | 5.02 | 13.88 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 31 | LC1 | mbEs | also | 565.347031 | 0.239784111022914 | 550 | 2086 | 5.17 | 13.37 |
| 32 | LC1 | fazEh | do | 567.479914 | 0.130569575703134 | 442 | 2614 | 4.23 | 14.78 |
| 33 | LC2 | akEh | those | 41.902091 | 0.080981477 6952678 | 547 | 1915 | 5.14 | 12.82 |
| 34 | LC2 | dEs | ten | 88.330361 | 0.130234136541247 | 529 | 2271 | 4.99 | 13.91 |
| 35 | LC2 | sabEh | know | 94.792304 | 0.076182994 1558574 | 401 | 2291 | 3.86 | 13.97 |
| 36 | LC2 | sabEh | know | 148.035803 | 0.080146636 7842636 | 636 | 1975 | 5.88 | 13.02 |
| 37 | LC2 | sEsta | sixth | 169.867534 | 0.143862254 103311 | 599 | 2167 | 5.58 | 13.62 |
| 38 | LC2 | sEstafera | Friday | 171.630683 | 0.095901794 7312759 | 566 | 1971 | 5.30 | 13.01 |
| 39 | LC2 | sEstafera | Friday | 184.064038 | 0.129482132 118795 | 588 | 2017 | 5.49 | 13.16 |
| 40 | LC2 | akEh | those | 211.635382 | 0.093219175 2365839 | 394 | 1749 | 3.79 | 12.23 |
| 41 | LC2 | akEh | those | 253.561561 | 0.040550899 8718744 | 391 | 1975 | 3.77 | 13.02 |
| 42 | LC2 | akEh | those | 265.31119 | 0.032613600 2988733 | 430 | 1501 | 4.12 | 11.21 |
| 43 | LC2 | pEdru | peter | 287.239733 | 0.089683320 6604697 | 440 | 2309 | 4.21 | 14.02 |
| 44 | LC2 | akEh | those | 342.487903 | 0.043448826 9407325 | 424 | 1703 | 4.07 | 12.05 |
| 45 | LC2 | kE | and | 348.014937 | 0.042844852 969381 | 426 | 2332 | 4.08 | 14.08 |
| 46 | LC3 | sabEh | know | 157.279835 | 0.084522562 66042470 | 541 | 2107 | 5.09 | 13.44 |
| 47 | LC3 | sabEh | know | 212.392625 | 0.109638655 93427600 | 658 | 2214 | 6.05 | 13.75 |
| 48 | LC3 | sEz | six | 259.973464 | 0.130180334 85576600 | 626 | 2431 | 5.80 | 14.34 |
| 49 | LC3 | sudEh | | 290.147750 | 0.069985409 42032610 | 606 | 2328 | 5.63 | 14.07 |
| 50 | LC3 | sampEh | until | 292.416144 | 0.052419085 4038693 | 449 | 2224 | 4.29 | 13.78 |
| 51 | LC3 | akEh | those | 375.105796 | 0.074104523 6663922 | 439 | 2401 | 4.20 | 14.26 |
| 52 | LC3 | trizEh | bring things | 380.085968 | 0.099813297 78190680 | 474 | 2343 | 4.51 | 14.11 |
| 53 | LC3 | prendEh | learn | 422.027616 | 0.097784859 07446570 | 561 | 2327 | 5.25 | 14.07 |
| 54 | LC3 | prendEh | learn | 423.657881 | 0.117364216 01096900 | 601 | 2630 | 5.60 | 14.82 |
| 55 | LC3 | sabEh | know | 427.283663 | 0.045468041 006472500 | 553 | 1909 | 5.19 | 12.80 |
| 56 | LC3 | kEbrah | | 446.859502 | 0.113708271 51608900 | 807 | 2186 | 7.19 | 13.67 |
| 57 | LC3 | akEh | those | 447.609755 | 0.077433945 98861640 | 613 | 2241 | 5.69 | 13.83 |
| 58 | LC3 | fazEh | do | 450.000412 | 0.043500624 089517700 | 494 | 2134 | 4.68 | 13.52 |
| 59 | LC3 | fazEh | do | 478.640450 | 0.039388091 0299913 | 570 | 2010 | 5.34 | 13.14 |
| 60 | LC3 | fazEh | do | 480.793948 | 0.051314606 666494500 | 573 | 2176 | 5.36 | 13.64 |
| 61 | LC3 | fazEh | do | 509.004153 | 0.029334424 28388840 | 495 | 1609 | 4.69 | 11.67 |
| 62 | LC3 | sabEh | know | 592.846887 | 0.071504973 8239486 | 488 | 2572 | 4.63 | 14.68 |
| 63 | LC3 | prendEh | learn | 882.971937 | 0.055072592 642886800 | 419 | 2446 | 4.02 | 14.38 |

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|---|---|---|---|---|---|---|---|---|---|
| 64 | LC3 | sabEh | know | 905.649855 | 0.070171375 27623160 | 468 | 2363 | 4.45 | 14.16 |
| 65 | LC3 | fazEh | do | 963.076063 | 0.052922399 81997680 | 484 | 2192 | 4.60 | 13.69 |
| 66 | LC4 | nasEh | born | 86.816016 | 0.249999258 135972 | 400 | 2619 | 3.85 | 14.79 |
| 67 | LC4 | nasEh | born | 127.816697 | 0.147329665 93598500 | 686 | 2476 | 6.28 | 14.45 |
| 68 | LC4 | krisEh | grew up | 128.39603 | 0.229804139 7127410 | 528 | 2531 | 4.98 | 14.59 |
| 69 | LC4 | sabEh | know | 170.471415 | 0.107365907 54854100 | 489 | 2532 | 4.64 | 14.59 |
| 70 | LC4 | sabEh | know | 174.271028 | 0.169110417 05660100 | 557 | 2444 | 5.22 | 14.37 |
| 71 | LC4 | sEti | seven | 213.126398 | 0.182171737 3830150 | 672 | 2440 | 6.17 | 14.36 |
| 72 | LC4 | prendEh | learn | 279.664602 | 0.175907976 4052560 | 492 | 2565 | 4.67 | 14.67 |
| 73 | LC4 | nasEh | born | 367.148946 | 0.086046443 39050080 | 643 | 2315 | 5.93 | 14.03 |
| 74 | LC4 | akeh | those | 374.692159 | 0.021023500 594708400 | 463 | 2172 | 4.41 | 13.63 |
| 75 | LC4 | akEh | those | 401.856731 | 0.052710876 153810200 | 600 | 2081 | 5.58 | 13.36 |
| 76 | LC4 | akEh | those | 407.537780 | 0.014579492 857251400 | 665 | 2140 | 6.11 | 13.54 |
| 77 | LC4 | akEh | those | 414.797033 | 0.026230964 76719410 | 475 | 2542 | 4.52 | 14.61 |
| 78 | LC4 | prendEh | learn | 422.823364 | 0.250497437 0608010 | 616 | 2488 | 5.72 | 14.48 |
| 79 | LC4 | ntEh | dont have | 445.871934 | 0.069093592 00983540 | 469 | 2544 | 4.47 | 14.62 |
| 80 | LC4 | akEh | those | 455.907967 | 0.035856316 483887000 | 451 | 2257 | 4.31 | 13.88 |
| 81 | LC4 | sEdu | early | 533.017710 | 0.157109409 44404700 | 435 | 2583 | 4.16 | 14.71 |
| 82 | LC4 | akEh | those | 533.923554 | 0.043008342 63119670 | 448 | 2423 | 4.28 | 14.32 |
| 83 | LC4 | sEdu | searly | 538.563222 | 0.184175891 11516000 | 396 | 2843 | 3.81 | 15.28 |
| 84 | LC4 | akEh | those | 541.874881 | 0.025688957 417969500 | 488 | 2361 | 4.63 | 14.16 |
| 85 | LC4 | sEdu | early | 545.35497 | 0.147405162 74787300 | 462 | 2777 | 4.40 | 15.14 |
| 86 | LC4 | akEh | those | 550.690326 | 0.036564745 12774820 | 498 | 2564 | 4.71 | 14.66 |
| 87 | LC4 | sudEh | | 553.005503 | 0.060020140 116080300 | 496 | 2548 | 4.70 | 14.63 |
| 88 | LC4 | pEsi | fish | 567.598404 | 0.236453152 10956100 | 389 | 2803 | 3.75 | 15.20 |
| 89 | LC4 | kresEh | grew up | 572.672043 | 0.244518050 2876380 | 528 | 2398 | 4.98 | 14.25 |
| 90 | LC4 | kuzEh | cook | 612.702417 | 0.171318377 3356380 | 474 | 2545 | 4.51 | 14.62 |
| 91 | LC4 | akEh | those | 614.661879 | 0.041098955 91136590 | 521 | 2389 | 4.92 | 14.23 |
| 92 | LC4 | kuzEh | cook | 618.421376 | 0.109358132 07163400 | 475 | 2480 | 4.52 | 14.46 |
| 93 | LC4 | kuzEh | cook | 620.575063 | 0.197308618 21494700 | 537 | 2199 | 5.06 | 13.71 |
| 94 | LC4 | kuzEh | cook | 622.885655 | 0.154432516 31995700 | 538 | 2430 | 5.06 | 14.34 |
| 95 | LC4 | kuzEh | cook | 634.108995 | 0.138106170 8202650 | 509 | 2447 | 4.81 | 14.38 |
| 96 | LC4 | pEsi | fish | 636.222081 | 0.140994654 15529300 | 639 | 2330 | 5.90 | 14.07 |

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|---|---|---|---|---|---|---|---|---|---|
| 97 | LC4 | pEsi | fish | 638.024347 | 0.208251021 85313000 | 491 | 2701 | 4.66 | 14.98 |
| 98 | LC4 | kEh | that | 639.227402 | 0.043916247 22848060 | 568 | 2534 | 5.32 | 14.59 |
| 99 | LC4 | pEsi | fish | 640.987805 | 0.174910756 7596870 | 439 | 2753 | 4.19 | 15.09 |
| 100 | LC4 | pEsi | fish | 642.342453 | 0.154117281 74524300 | 469 | 2715 | 4.46 | 15.01 |
| 101 | LC4 | pEskədor | fishermen | 644.681480 | 0.085956828 1208567 | 640 | 2079 | 5.91 | 13.35 |
| 102 | LC4 | akEh | those | 652.068779 | 0.015182225 393346000 | 529 | 2331 | 4.99 | 14.08 |
| 103 | LC4 | mbEs | also | 656.381265 | 0.405874019 11739100 | 469 | 2530 | 4.46 | 14.58 |
| 104 | LC4 | bEs | also? | 657.828643 | 0.185546838 05325600 | 403 | 2635 | 3.87 | 14.83 |
| 105 | LC4 | pEsi | fish | 667.119591 | 0.196702378 02995400 | 562 | 2732 | 5.27 | 15.05 |
| 106 | LC4 | pEsi | fish | 667.991917 | 0.101831432 40033100 | 570 | 2646 | 5.33 | 14.86 |
| 107 | LC4 | sEku | dry | 689.460925 | 0.161592765 12439600 | 549 | 2380 | 5.16 | 14.21 |
| 108 | LC4 | pEsi | fish | 699.096104 | 0.223232885 41179000 | 481 | 2637 | 4.57 | 14.83 |
| 109 | LC4 | fazEh | do | 699.975172 | 0.063910814 68768790 | 447 | 2315 | 4.27 | 14.03 |
| 110 | LC4 | fazEh | do | 702.350716 | 0.086137127 95533960 | 512 | 2286 | 4.84 | 13.95 |
| 111 | LC4 | kEh | which | 707.958227 | 0.208878496 49113800 | 612 | 2274 | 5.69 | 13.92 |
| 112 | LC4 | kuzEh | cook | 739.800410 | 0.088698849 03776890 | 438 | 1992 | 4.19 | 13.08 |
| 113 | LC4 | padEh | for | 740.453535 | 0.233804814 94314200 | 557 | 2521 | 5.23 | 14.56 |
| 114 | LC4 | kuzEh | cook | 748.140841 | 0.261640452 485949 | 472 | 2556 | 4.49 | 14.64 |
| 115 | LC4 | ntEh | dont have | 749.957110 | 0.091231991 63184380 | 457 | 2757 | 4.36 | 15.10 |
| 116 | LC4 | kuzEh | cook | 752.519407 | 0.258420610 1092830 | 522 | 2415 | 4.93 | 14.30 |
| 117 | LC4 | akEh | those | 753.774609 | 0.037029719 625252300 | 500 | 2506 | 4.74 | 14.52 |
| 118 | LC4 | pEsi | fish | 754.028550 | 0.211179683 54576500 | 541 | 2690 | 5.09 | 14.95 |
| 119 | LC4 | kuzEh | cook | 765.200541 | 0.052011635 38106360 | 493 | 2133 | 4.68 | 13.52 |
| 120 | LC4 | dEvəl | devil | 775.573948 | 0.179417411 14168500 | 538 | 2444 | 5.07 | 14.37 |
| 121 | LC4 | ntEh | dont have | 776.035923 | 0.061557889 420100800 | 507 | 2470 | 4.79 | 14.43 |
| 122 | LC4 | akEh | those | 778.013033 | 0.055374275 659005400 | 534 | 2308 | 5.03 | 14.02 |
| 123 | LC4 | akEh | those | 827.615400 | 0.026533240 343042100 | 480 | 2267 | 4.56 | 13.90 |
| 124 | LC4 | intendEh | understand | 830.939039 | 0.061428625 071243900 | 582 | 2532 | 5.43 | 14.59 |
| 125 | LC4 | intendEh | understand | 874.175363 | 0.208217450 76477800 | 461 | 2830 | 4.39 | 15.26 |
| 126 | LC4 | intendEh | understand | 896.232557 | 0.144687577 6281330 | 502 | 2649 | 4.75 | 14.86 |
| 127 | LC4 | kEh | which | 897.603041 | 0.169024662 1069490 | 604 | 2345 | 5.62 | 14.11 |
| 128 | LC4 | prendEh | learn | 898.662975 | 0.075432727 30424630 | 521 | 2296 | 4.92 | 13.98 |
| 129 | LC4 | prendEh | learn | 916.946857 | 0.218265499 12646000 | 515 | 2651 | 4.87 | 14.87 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 130 | LC5 | sEz | six | 63.740976 | 0.12558335929777100 | 445 | 2277 | 4.25 | 13.93 |
| 131 | LC5 | fazEh | do | 66.438522 | 0.11459150841122300 | 484 | 2266 | 4.60 | 13.90 |
| 132 | LC5 | fazEh | do | 68.594301 | 0.30201286944937100 | 513 | 2398 | 4.85 | 14.25 |
| 133 | LC5 | fazEh | do | 69.674924 | 0.19458197187752500 | 457 | 1919 | 4.36 | 12.84 |
| 134 | LC5 | dEs | ten | 72.227569 | 0.11090620547068400 | 503 | 1701 | 4.76 | 12.04 |
| 135 | LC5 | sEti | seven | 99.430361 | 0.13514780787052400 | 606 | 1558 | 5.63 | 11.45 |
| 136 | LC5 | disEs | sixteen | 113.337341 | 0.1401788109718610 | 471 | 2473 | 4.48 | 14.44 |
| 137 | LC5 | prendEh | do | 176.712109 | 0.32997331710103600 | 443 | 1651 | 4.23 | 11.84 |
| 138 | LC5 | sabEh | know | 442.155028 | 0.05289276779433290 | 470 | 1916 | 4.47 | 12.83 |
| 139 | LC5 | fazEh | do | 481.097872 | 0.16142493118684300 | 486 | 1695 | 4.61 | 12.02 |
| 140 | LC5 | pesi | fish | 489.099279 | 0.23894131885015200 | 450 | 1598 | 4.30 | 11.62 |
| 141 | LC5 | pesi | fish | 492.896858 | 0.23103472734186400 | 398 | 2078 | 3.83 | 13.35 |
| 142 | LC5 | bEbeh | drink | 496.958121 | 0.07727869554776130 | 492 | 2346 | 4.67 | 14.12 |
| 143 | LC5 | bebEh | drink | 497.098278 | 0.03647938423375760 | 432 | 2048 | 4.14 | 13.26 |
| 144 | LC5 | pEgah | catch | 501.363252 | 0.06090147517642210 | 694 | 2030 | 6.34 | 13.20 |
| 145 | LC5 | pEsi | fish | 501.636703 | 0.04672153647045100 | 562 | 2055 | 5.26 | 13.28 |
| 146 | LC5 | prendEh | do | 543.135297 | 0.23985388958624300 | 482 | 2377 | 4.58 | 14.20 |
| 147 | LC5 | prendEh | do | 546.270877 | 0.10719112599031200 | 506 | 2118 | 4.79 | 13.47 |
| 148 | LC5 | kuzEh | cook | 547.423741 | 0.09945898563921670 | 509 | 1953 | 4.81 | 12.95 |
| 149 | LC5 | fazEh | do | 550.418194 | 0.04985978552679170 | 467 | 2133 | 4.44 | 13.52 |
| 150 | LC5 | akEh | those | 557.586191 | 0.03615839153678730 | 467 | 1778 | 4.45 | 12.34 |
| 151 | LC5 | dEs | ten | 563.588488 | 0.0978227102193614 | 551 | 1306 | 5.17 | 10.27 |
| 152 | LC5 | sEdu | early | 575.002971 | 0.08847589907497880 | 432 | 2029 | 4.14 | 13.20 |
| 153 | LC5 | prendEh | do | 586.662675 | 0.0784929666779135 | 544 | 2470 | 5.11 | 14.44 |
| 154 | LC5 | fazEh | do | 638.854495 | 0.2174907244697120 | 553 | 2367 | 5.19 | 14.17 |
| 155 | LC5 | sabEh | know | 640.130739 | 0.08373151509977110 | 440 | 1308 | 4.21 | 10.28 |
| 156 | LC5 | disEs | sixteen | 653.016659 | 0.12734270053533700 | 433 | 1474 | 4.14 | 11.08 |
| 157 | LC5 | akEh | those | 661.217593 | 0.05075105574724150 | 533 | 1731 | 5.02 | 12.16 |
| 158 | LC5 | fazEh | do | 670.041116 | 0.06879113216859880 | 537 | 2117 | 5.06 | 13.47 |
| 159 | LC5 | akEh | those | 675.628722 | 0.03993320908989520 | 468 | 1464 | 4.46 | 11.04 |
| 160 | LC5 | ntEh | dont have | 716.889216 | 0.34943993180604600 | 465 | 2548 | 4.43 | 14.63 |
| 161 | LC5 | prendEh | do | 718.951662 | 0.17783694906552200 | 436 | 1739 | 4.18 | 12.19 |
| 162 | LC5 | prendEh | do | 721.731419 | 0.1857418774884540 | 574 | 1969 | 5.37 | 13.00 |

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|---|---|---|---|---|---|---|---|---|---|
| 163 | LC5 | fazEh | do | 789.441429 | 0.069198715 53816390 | 508 | 1958 | 4.81 | 12.97 |
| 164 | LC5 | kuzEh | cook | 827.473496 | 0.127646116 89408400 | 566 | 2394 | 5.30 | 14.24 |
| 165 | LC5 | mbEs | also | 844.479227 | 0.110191410 88502200 | 413 | 1968 | 3.97 | 13.00 |
| 166 | LC5 | mbEs | also | 853.614522 | 0.202566698 22947500 | 532 | 1984 | 5.01 | 13.05 |
| 167 | LC5 | ntEh | dont have | 864.317961 | 0.054617324 45735380 | 441 | 1584 | 4.21 | 11.56 |
| 168 | LC5 | fazEh | do | 872.918370 | 0.045404651 98226680 | 454 | 1824 | 4.33 | 12.50 |
| 169 | LC5 | mbEs | also | 892.769943 | 0.074665917 44616840 | 477 | 2320 | 4.54 | 14.05 |
| 170 | LC5 | fazEh | do | 926.884982 | 0.118537027 27876200 | 451 | 1054 | 4.31 | 8.85 |
| 171 | LC5 | sEku | dry | 982.358439 | 0.125193111 95217100 | 704 | 1573 | 6.42 | 11.52 |
| 172 | LC5 | azEti | oil | 1000.102973 | 0.108764902 21198800 | 591 | 2729 | 5.51 | 15.04 |
| 173 | LC5 | akEh | those | 1001.526527 | 0.041102356 59027240 | 505 | 627 | 4.78 | 5.81 |
| 174 | LC5 | dEsah | these | 1002.112457 | 0.067306167 00519930 | 548 | 1468 | 5.15 | 11.05 |
| 175 | LC5 | dEsah | these | 1003.935928 | 0.051443269 999481300 | 527 | 1906 | 4.97 | 12.79 |
| 176 | LC5 | fazEh | do | 1012.721243 | 0.085956733 61878650 | 433 | 1904 | 4.15 | 12.79 |
| 177 | LC5 | sEz | six | 1035.001793 | 0.099361326 09550440 | 521 | 1262 | 4.92 | 10.04 |
| 178 | LC5 | sEz | six | 1035.974857 | 0.120065612 27212800 | 592 | 2539 | 5.52 | 14.60 |
| 179 | LC5 | sEz | six | 1039.744083 | 0.114663261 63099400 | 521 | 1575 | 4.92 | 11.53 |
| 180 | LC5 | fubEh | boiling | 1067.513454 | 0.177435780 96656200 | 462 | 1690 | 4.40 | 12.00 |
| 181 | LC5 | akEh | those | 1046.8 | 0.040840638 8810363 | 566 | 1702 | 5.30 | 12.05 |
| 182 | LC5 | sEku | dry | 1117.916199 | 0.147391885 89624100 | 705 | 1145 | 6.42 | 9.39 |
| | Ave | | | | 0.12912 | 507.08 | 2251.680 | 4.79 | 13.720 |
| | SD | | | | 0.08577 | 72.21 | 389.81 | 0.61 | 1.33 |

# APPENDIX B3 - MPC /ə/

| No | /ə/ | Word | Meaning | Time | Duration | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | LC1 | satentə | sixty | 26.1161 | 0.0828448640026878 | 546 | 2233 | 5.13 | 13.81 |
| 2 | LC1 | satentə | sixty | 27.526 | 0.0874809511137435 | 551 | 2100 | 5.17 | 13.42 |
| 3 | LC1 | festibəl | festival | 184.307027 | 0.23078487172333 | 620 | 1864 | 5.75 | 12.65 |
| 4 | LC1 | festibəl | festival | 186.682428 | 0.387165832667819 | 534 | 1784 | 5.03 | 12.36 |
| 5 | LC1 | yosə | my / mine | 286.943 | 0.089923 | 567 | 2063 | 5.31 | 13.30 |
| 6 | LC1 | kazə | home | 306.777942 | 0.186829001779017 | 657 | 2068 | 6.04 | 13.32 |
| 7 | LC1 | jə | already | 308.249 | 0.062897 | 415 | 2389 | 3.98 | 14.23 |
| 8 | LC1 | portəgis | portuguese | 339.84 | 0.038131 | 441 | 2153 | 4.22 | 13.58 |
| 9 | LC1 | yosə | my / mine | 356.632446 | 0.538519837041974 | 660 | 2035 | 6.07 | 13.21 |
| 10 | LC1 | jə | already | 500.811 | 0.044935 | 466 | 2430 | 4.44 | 14.34 |
| 11 | LC2 | yosə | my/ mine | 28.3074 | 0.082968 | 518 | 1561 | 4.89 | 11.47 |
| 12 | LC2 | jə | alreay | 56.3002 | 0.023122 | 451 | 1867 | 4.30 | 12.66 |
| 13 | LC2 | batatə | potato | 207.665421 | 0.0841498304082506 | 432 | 1458 | 4.13 | 11.01 |
| 14 | LC2 | botəh | put | 347.870692 | 0.0199942647190596 | 462 | 1935 | 4.40 | 12.89 |
| 15 | LC2 | trempə | spices /seasoning | 348.516221 | 0.0499856617976775 | 534 | 1328 | 5.03 | 10.38 |
| 16 | LC2 | botƏh | put | 351.327341 | 0.0635518490452682 | 472 | 1786 | 4.49 | 12.36 |
| 17 | LC2 | kabəh | after that | 353.073581 | 0.104884946658387 | 526 | 1374 | 4.96 | 10.61 |
| 18 | LC2 | botək | put | 355.157546 | 0.0833574368929817 | 460 | 1870 | 4.38 | 12.67 |
| 19 | LC3 | kazə | marry | 220.057858 | 0.03518634744389710 | 652 | 1626 | 6.01 | 11.74 |
| 20 | LC3 | fikəh | stay | 444.154853 | 0.15321611358950800 | 669 | 1741 | 6.14 | 12.20 |
| 21 | LC3 | batatə | potatoes | 954.868180 | 0.2314004325806990 | 599 | 1915 | 5.58 | 12.82 |
| 22 | LC4 | səsenta | sixty | 63.636416 | 0.0497492150464964 0 | 555 | 1700 | 5.21 | 12.04 |
| 23 | LC4 | səsenta | sixty | 67.920003 | 0.0711368899330722 0 | 601 | 1699 | 5.59 | 12.03 |
| 24 | LC4 | səsenta | sixty | 120.909944 | 0.0538238845670520 00 | 606 | 1851 | 5.64 | 12.60 |
| 25 | LC4 | kabəh | then | 156.348379 | 0.4585773757439990 | 635 | 1678 | 5.87 | 11.95 |
| 26 | LC4 | fikəh | stay | 246.556 | 0.06011927 | 503 | 1143 | 4.76 | 9.38 |
| 27 | LC4 | kabəh | then | 275.426551 | 0.4138836882831360 | 610 | 1855 | 5.67 | 12.61 |
| 28 | LC4 | kə | that | 278.643072 | 0.0248032466569157 0 | 468 | 2405 | 4.45 | 14.27 |
| 29 | LC4 | jə | already | 279.056 | 0.0423303 | 482 | 2077 | 4.58 | 13.35 |
| 30 | LC4 | kabəh | then | 285.978509 | 0.3042397692994430 0 | 673 | 1665 | 6.18 | 11.90 |
| 31 | LC4 | kazə | home | 372.935425 | 0.0433501622967469 0 | 644 | 1642 | 5.94 | 11.80 |
| 32 | LC4 | padri sə chang | own( possessive) | 405.067499 | 0.0680646774171692 0 | 545 | 2177 | 5.13 | 13.65 |
| 33 | LC4 | kabəh | then | 432.185678 | 0.0600142754168473 0 | 566 | 1613 | 5.30 | 11.69 |
| 34 | LC4 | sə | 3rd person possessive | 566.773 | 0.0424918714928708 | 581 | 1704 | 5.42 | 12.05 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 35 | LC4 | kazə | home | 568.440797 | 0.029827145 95134440 | 472 | 1653 | 4.49 | 11.85 |
| 36 | LC4 | tə | is /going to | 572.206828 | 0.042097284 473243200 | 531 | 2054 | 5.00 | 13.28 |
| 37 | LC4 | kə | that | 624.003682 | 0.059929036 18391670 | 512 | 2445 | 4.84 | 14.37 |
| 38 | LC4 | peskədor | fishermen | 644.953303 | 0.039438569 40691150 | 549 | 1820 | 5.16 | 12.49 |
| 39 | LC4 | akəh | those | 668.784806 | 0.026947968 23982410 | 514 | 2381 | 4.86 | 14.21 |
| 40 | LC4 | yosə | my | 734.577032 | 0.030198912 45673990 | 437 | 1838 | 4.18 | 12.55 |
| 41 | LC4 | kə | or | 782.900916 | 0.121058188 2551200 | 625 | 1294 | 5.79 | 10.21 |
| 42 | LC5 | kabəh | then | 123.361 | 0.075034 | 553 | 1249 | 5.19 | 9.97 |
| 43 | LC5 | kabəh | then | 178.743265 | 0.066181634 73314100 | 522 | 1243 | 4.93 | 9.94 |
| 44 | LC5 | kazə | home | 195.442387 | 0.114021964 69279600 | 479 | 1618 | 4.55 | 11.71 |
| 45 | LC5 | kazə | home | 206.200259 | 0.089409418 05710170 | 498 | 1834 | 4.72 | 12.54 |
| 46 | LC5 | pəgah | catch | 492.513723 | 0.105450927 48566300 | 514 | 1806 | 4.86 | 12.44 |
| 47 | LC5 | kazə | home | 494.880544 | 0.172535328 882077 | 540 | 1554 | 5.08 | 11.44 |
| 48 | LC5 | tokəh | knock/ play | 553.402624 | 0.019089684 821096900 | 649 | 1001 | 5.98 | 8.52 |
| 49 | LC5 | ngkə | no | 560.302281 | 0.183969452 47025100 | 503 | 1568 | 4.76 | 11.50 |
| 50 | LC5 | butikə | shop | 578.057353 | 0.037061455 22789940 | 507 | 1278 | 4.80 | 10.12 |
| 51 | LC5 | tokəh | knock/ play | 581.487043 | 0.039328646 913531900 | 711 | 1679 | 6.47 | 11.96 |
| 52 | LC5 | bokəh | mouth | 664.881089 | 0.158225003 93767300 | 783 | 1586 | 7.01 | 11.57 |
| 53 | LC5 | mandəh | send | 727.616847 | 0.048161438 135593900 | 630 | 1591 | 5.83 | 11.59 |
| 54 | LC5 | labəh | wash | 796.800097 | 0.081305368 28514320 | 601 | 1261 | 5.59 | 10.03 |
| 55 | LC5 | kabəh | then | 960.111084 | 0.072282638 83860110 | 576 | 1603 | 5.38 | 11.64 |
| 56 | LC5 | desəh | those | 1004.116639 | 0.069910084 87113960 | 504 | 1764 | 4.77 | 12.28 |
| 57 | LC5 | botəh | put | 1007.469017 | 0.174090114 51934500 | 652 | 1442 | 6.01 | 10.93 |
| 58 | LC5 | kortəh | cut | 1041.618434 | 0.041151938 67869490 | 589 | 1383 | 5.49 | 10.65 |
| 59 | LC5 | kabəh | then | 1043.852272 | 0.044973064 062332900 | 472 | 1075 | 4.49 | 8.98 |
| 60 | LC5 | botəh | put | 1044.119870 | 0.032707451 582155000 | 543 | 1829 | 5.11 | 12.52 |
| 61 | LC5 | kabəh | then | 79.1588 | 0.050891172 0983178 | 542 | 1179 | 5.10 | 9.58 |
| 62 | LC5 | kabəh | then | 108.772 | 0.090015 | 517 | 1267 | 4.88 | 10.07 |
| 63 | LC5 | fikəh | stay | 388.87 | 0.031256 | 501 | 1494 | 4.74 | 11.17 |
| | Ave | | | | **0.10350** | **551.15** | **1723.43** | **5.16** | **11.98** |
| | SD | | | | **0.10831** | **76.28** | **349.55** | **0.64** | **1.38** |

## APPENDIX B4 - MPC /u/

| No | /u/ | Word | meaninging | Time | Duration | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | LC1 | singkU | five | 28.154558 | 0.137145176866028 | 440 | 919 | 4.21 | 7.98 |
| 2 | LC1 | tUdu | all | 66.236599 | 0.079617042 5162899 | 413 | 1878 | 3.96 | 12.69 |
| 3 | LC1 | tudUkristang | all kristangs | 66.484407 | 0.302544761 561904 | 420 | 1229 | 4.03 | 9.86 |
| 4 | LC1 | kU | with | 100.102077 | 0.104792395 834679 | 355 | 1138 | 3.43 | 9.35 |
| 5 | LC1 | justU | only | 119.816324 | 0.206872506 440646 | 436 | 1345 | 4.18 | 10.46 |
| 6 | LC1 | nubU | new | 159.50123 | 0.046605678 5942612 | 410 | 1738 | 3.94 | 12.18 |
| 7 | LC1 | tUdu | all | 164.007783 | 0.065302687 8777894 | 390 | 2109 | 3.75 | 13.45 |
| 8 | LC1 | tudU | all | 164.109818 | 0.044895597 9159678 | 413 | 1972 | 3.96 | 13.01 |
| 9 | LC1 | tUdu | all | 167.703933 | 0.085062579 18404 | 423 | 1736 | 4.06 | 12.18 |
| 10 | LC1 | tudU | all | 167.872142 | 0.162461862 946117 | 439 | 1642 | 4.20 | 11.80 |
| 11 | LC1 | tUdu | all | 191.877534 | 0.077396222 8233245 | 373 | 1668 | 3.60 | 11.91 |
| 12 | LC1 | tudUjenti | all people | 192.005097 | 0.067494701 2963969 | 370 | 2431 | 3.57 | 14.34 |
| 13 | LC1 | kUbinti | with twenty | 196.255373 | 0.083057076 3153844 | 442 | 1622 | 4.23 | 11.72 |
| 14 | LC1 | kUbinti | with twenty | 209.62018 | 0.065340868 0259417 | 406 | 1268 | 3.91 | 10.07 |
| 15 | LC1 | kUkis | cookies | 242.335457 | 0.075995770 4065357 | 394 | 1131 | 3.79 | 9.31 |
| 16 | LC1 | jUdah | help | 242.971606 | 0.083935416 6494104 | 410 | 1854 | 3.94 | 12.61 |
| 17 | LC1 | kUkis | cookies | 245.577442 | 0.067139779 6179747 | 629 | 1780 | 5.82 | 12.34 |
| 18 | LC1 | kUkis | cookies | 262.696302 | 0.081070775 5283033 | 478 | 1006 | 4.54 | 8.55 |
| 19 | LC1 | sabdU | saturday | 271.374233 | 0.059945197 9868491 | 482 | 1663 | 4.58 | 11.89 |
| 20 | LC1 | jUstu | only | 279.118738 | 0.110156051 787897 | 421 | 2065 | 4.04 | 13.31 |
| 21 | LC1 | kU | with | 286.253849 | 0.065593122 289556 | 424 | 1671 | 4.07 | 11.92 |
| 22 | LC1 | tUdu | all | 286.464738 | 0.090130053 658811 | 424 | 1564 | 4.06 | 11.48 |
| 23 | LC1 | olotUbai | they went | 312.725379 | 0.020496981 1253477 | 489 | 1912 | 4.64 | 12.81 |
| 24 | LC1 | olotUbeng | they came | 314.137181 | 0.020047267 8871506 | 417 | 2040 | 4.00 | 13.23 |
| 25 | LC1 | tUdu | all | 325.287178 | 0.118677640 977523 | 443 | 1780 | 4.24 | 12.34 |
| 26 | LC1 | tUdu | all | 330.93447 | 0.054141032 1410467 | 432 | 1964 | 4.13 | 12.99 |
| 27 | LC1 | kUkus | steam | 331.81115 | 0.086118970 7770222 | 443 | 867 | 4.23 | 7.62 |
| 28 | LC1 | kukUs | steam | 332.046844 | 0.131444744 870237 | 414 | 1094 | 3.97 | 9.09 |
| 29 | LC1 | kUkus | steam | 332.447655 | 0.052115380 9789325 | 374 | 1157 | 3.61 | 9.46 |
| 30 | LC1 | kukUs | steam | 332.639593 | 0.113128509 929822 | 418 | 1309 | 4.01 | 10.28 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 31 | LC1 | portUgis | portuguese | 338.454351 | 0.036855989818207 | 405 | 2141 | 3.89 | 13.54 |
| 32 | LC1 | kUkis | cookies | 340.638957 | 0.074178904 2211281 | 386 | 1112 | 3.72 | 9.20 |
| 33 | LC1 | olotU | they | 386.322386 | 0.052805379 237725 | 457 | 1742 | 4.36 | 12.20 |
| 34 | LC1 | olotU | they | 448.208419 | 0.066279338 0448647 | 381 | 1755 | 3.67 | 12.25 |
| 35 | LC1 | olotU | they | 453.974229 | 0.135202934 173037 | 523 | 1335 | 4.93 | 10.42 |
| 36 | LC1 | olotUpapiah | they | 475.319161 | 0.358494001 644544 | 435 | 1241 | 4.17 | 9.92 |
| 37 | LC2 | machU | boy | 64.519638 | 0.084173193 0511287 | 414 | 1426 | 3.98 | 10.86 |
| 38 | LC2 | kU | with | 96.262375 | 0.047616464 4039443 | 371 | 1574 | 3.58 | 11.52 |
| 39 | LC2 | tUdu | all | 117.303954 | 0.071011242 2495257 | 411 | 1471 | 3.95 | 11.07 |
| 40 | LC2 | tudU | all | 117.422306 | 0.071011242 2495399 | 423 | 1237 | 4.05 | 9.90 |
| 41 | LC2 | retU | correct | 149.296061 | 0.072731595 8822601 | 481 | 1490 | 4.57 | 11.15 |
| 42 | LC2 | tUdu | all | 155.598452 | 0.043640743 3518866 | 479 | 1492 | 4.55 | 11.16 |
| 43 | LC2 | tudU | all | 155.703546 | 0.065906428 7355022 | 504 | 1288 | 4.77 | 10.17 |
| 44 | LC2 | kazamintU | wedding | 167.058525 | 0.249432571 625562 | 438 | 1078 | 4.19 | 9.00 |
| 45 | LC2 | sabdU | saturday | 177.465667 | 0.097144977 6832003 | 415 | 1213 | 3.99 | 9.78 |
| 46 | LC2 | nuibU | bridegroom | 185.951893 | 0.095598432 5327108 | 439 | 1226 | 4.20 | 9.84 |
| 47 | LC2 | sabdU | saturday | 188.281021 | 0.038289258 0961709 | 353 | 1491 | 3.41 | 11.16 |
| 48 | LC2 | kazamintU | wedding | 208.19672 | 0.095699807 130984 | 437 | 1188 | 4.18 | 9.63 |
| 49 | LC2 | fikU | banana | 209.548885 | 0.094343869 2696077 | 380 | 1172 | 3.67 | 9.54 |
| 50 | LC2 | fritU | fried | 210.092649 | 0.106351270 813008 | 417 | 1383 | 4.00 | 10.65 |
| 51 | LC2 | singkU | five | 224.286737 | 0.024046418 0285471 | 373 | 1337 | 3.60 | 10.42 |
| 52 | LC2 | tUdu | all | 266.405114 | 0.070953900 0628183 | 388 | 1483 | 3.74 | 11.12 |
| 53 | LC2 | tudU | all | 284.826247 | 0.104752883 830258 | 418 | 1393 | 4.01 | 10.70 |
| 54 | LC2 | olotU | they | 347.023754 | 0.083304407 7141381 | 353 | 1639 | 3.41 | 11.79 |
| 55 | LC2 | kUzinyah | cooking | 356.177263 | 0.037470678 829834 | 462 | 1582 | 4.41 | 11.56 |
| 56 | LC3 | tUdu | all | 478.827999 | 0.044310500 497033400 | 569 | 1497 | 5.33 | 11.18 |
| 57 | LC3 | tUdu | all | 904.420370 | 0.072929154 64836370 | 459 | 1245 | 4.38 | 9.95 |
| 58 | LC4 | kU | with | 156.829882 | 0.040726232 304109500 | 554 | 1007 | 5.20 | 8.56 |
| 59 | LC4 | machU | boy | 215.041968 | 0.080334740 53047480 | 519 | 1681 | 4.90 | 11.96 |
| 60 | LC4 | machU | boy | 217.943947 | 0.076731757 791066 | 558 | 1561 | 5.24 | 11.47 |
| 61 | LC4 | machU | boy | 223.556953 | 0.092019095 84115240 | 483 | 1532 | 4.59 | 11.34 |
| 62 | LC4 | tUdu | all | 373.675948 | 0.026738672 322153400 | 471 | 1727 | 4.48 | 12.14 |
| 63 | LC4 | tudU | all | 373.743463 | 0.038102608 05909140 | 473 | 1830 | 4.50 | 12.52 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 64 | LC4 | tUdu | all | 379.249753 | 0.057218686 37516540 | 515 | 1420 | 4.86 | 10.83 |
| 65 | LC4 | tudU | all | 379.356442 | 0.027417287 221453500 | 498 | 1692 | 4.72 | 12.00 |
| 66 | LC4 | tUdu | all | 439.043006 | 0.061717038 98542090 | 601 | 1829 | 5.60 | 12.52 |
| 67 | LC4 | tudU | all | 439.152553 | 0.060174113 01075980 | 572 | 1808 | 5.35 | 12.44 |
| 68 | LC4 | tUdu | all | 441.601066 | 0.057726511 794442100 | 532 | 1846 | 5.01 | 12.58 |
| 69 | LC4 | tUdu | all | 460.531849 | 0.064693949 74118360 | 443 | 1605 | 4.23 | 11.65 |
| 70 | LC4 | sUdeh | Already. | 552.882853 | 0.026965570 19703500 | 558 | 2091 | 5.24 | 13.39 |
| 71 | LC4 | tantU | many | 553.58405 | 0.058956184 08931110 | 537 | 1182 | 5.06 | 9.60 |
| 72 | LC4 | bUtika | shop | 558.790794 | 0.049900271 24824790 | 465 | 2028 | 4.43 | 13.19 |
| 73 | LC4 | kUzinyah | cooking | 566.043032 | 0.066288551 51723200 | 452 | 1936 | 4.31 | 12.89 |
| 74 | LC4 | bredU | vegetables | 567.34034 | 0.044493872 70881290 | 384 | 1573 | 3.70 | 11.52 |
| 75 | LC4 | kUzinyah | cooking | 568.577546 | 0.045130672 659752200 | 460 | 1766 | 4.39 | 12.29 |
| 76 | LC4 | olotU | they | 576.144425 | 0.039538894 00486330 | 462 | 1647 | 4.40 | 11.82 |
| 77 | LC4 | bUtika | shop | 580.744462 | 0.034923313 80402900 | 512 | 1257 | 4.84 | 10.01 |
| 78 | LC4 | kUzinyah | cooking | 582.535803 | 0.061239997 84733770 | 485 | 1233 | 4.61 | 9.88 |
| 79 | LC4 | olotU | they | 584.789308 | 0.111157379 63314100 | 577 | 1365 | 5.39 | 10.57 |
| 80 | LC4 | kUzinyah | cooking | 594.849635 | 0.046092461 741977800 | 574 | 1373 | 5.37 | 10.60 |
| 81 | LC4 | kUzinyah | cooking | 595.547267 | 0.049341629 19380470 | 525 | 1607 | 4.95 | 11.66 |
| 82 | LC4 | olotU | they | 596.428132 | 0.068339193 88793670 | 558 | 1882 | 5.23 | 12.71 |
| 83 | LC4 | nitU | grandchildren | 597.231974 | 0.041797821 10611540 | 426 | 2027 | 4.08 | 13.19 |
| 84 | LC4 | kUzinyah | cooking | 600.481284 | 0.060025785 55296620 | 461 | 1715 | 4.39 | 12.10 |
| 85 | LC4 | kUzinyah | cooking | 603.66278 | 0.077844357 24749980 | 483 | 1732 | 4.59 | 12.16 |
| 86 | LC4 | kUzeh | cook | 612.488269 | 0.073762079 13057440 | 483 | 1062 | 4.59 | 8.90 |
| 87 | LC4 | kUzeh | cook | 618.278429 | 0.047648900 402578000 | 475 | 1800 | 4.52 | 12.42 |
| 88 | LC4 | kUzeh | cook | 620.420789 | 0.049970075 16294620 | 483 | 1732 | 4.58 | 12.16 |
| 89 | LC4 | kUzeh | cook | 622.690776 | 0.086408669 84569580 | 479 | 1638 | 4.55 | 11.79 |
| 90 | LC4 | kUzeh | cook | 633.962803 | 0.095162677 50018410 | 450 | 1413 | 4.30 | 10.80 |
| 91 | LC5 | jUdah | help | 74.883196 | 0.115932122 92172000 | 420 | 1658 | 4.03 | 11.87 |
| 92 | LC5 | kUzinyah | cook | 79.794138 | 0.051992669 415156500 | 432 | 1849 | 4.14 | 12.59 |
| 93 | LC5 | kUzinyah | cook | 200.586884 | 0.060342473 55842130 | 411 | 2146 | 3.95 | 13.55 |
| 94 | LC5 | tUdu | all | 258.498721 | 0.072241068 88111240 | 509 | 1562 | 4.81 | 11.47 |
| 95 | LC5 | tudU | all | 258.60513 | 0.066383684 91780970 | 494 | 1269 | 4.69 | 10.08 |
| 96 | LC5 | tUdu | all | 377.100193 | 0.111092880 94758100 | 388 | 1453 | 3.73 | 10.99 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 97 | LC5 | tUdu | all | 463.565092 | 0.11695784907908500 | 437 | 1201 | 4.18 | 9.71 |
| 98 | LC5 | tUdu | all | 469.531346 | 0.05550773029415270 | 458 | 1905 | 4.37 | 12.79 |
| 99 | LC5 | tudU | all | 469.687296 | 0.18370415502107600 | 493 | 895 | 4.68 | 7.81 |
| 100 | LC5 | tUdu | all | 485.714721 | 0.060509196788189 | 523 | 1870 | 4.94 | 12.67 |
| 101 | LC5 | tudU | all | 485.821873 | 0.06176980505466640 | 473 | 2035 | 4.50 | 13.22 |
| 102 | LC5 | kUzeh | cook | 547.267319 | 0.09132143226872810 | 441 | 1661 | 4.22 | 11.88 |
| 103 | LC5 | kUzinyah | cooking | 548.145075 | 0.06010845396690460 | 509 | 1784 | 4.81 | 12.36 |
| 104 | LC5 | bUtika | shop | 553.687664 | 0.05912147237893350 | 424 | 1649 | 4.06 | 11.83 |
| 105 | LC5 | bUtika | shop | 577.773215 | 0.04155375283130520 | 609 | 1921 | 5.66 | 12.84 |
| 106 | LC5 | tUdu | all | 790.179970 | 0.07595497586589770 | 443 | 1349 | 4.24 | 10.48 |
| 107 | LC5 | kUzinyah | cooking | 812.707623 | 0.07401281779254990 | 485 | 1253 | 4.61 | 9.99 |
| 108 | LC5 | bUtika | shop | 814.457360 | 0.07454919644555960 | 475 | 1435 | 4.52 | 10.90 |
| 109 | LC5 | kUzinyah | cooking | 815.488395 | 0.05292527679887370 | 531 | 1336 | 5.01 | 10.42 |
| 110 | LC5 | sUsi | sister | 823.026796 | 0.03485862038940010 | 500 | 1685 | 4.74 | 11.98 |
| 111 | LC5 | kUzeh | cook | 827.288964 | 0.06104814286243250 | 484 | 1390 | 4.60 | 10.69 |
| 112 | LC5 | fUbeh | boil | 1067.290938 | 0.06334507075825970 | 587 | 1771 | 5.48 | 12.31 |
| 113 | LC5 | tUdu | all | 1087.891226 | 0.10622674727119400 | 614 | 1047 | 5.70 | 8.81 |
| 114 | LC5 | tUdu | all | 1088.891258 | 0.05185618637028700 | 509 | 1562 | 4.81 | 11.47 |
| | Ave | | | | 0.07808 | 460.55 | 1553.10 | 4.39 | 11.28 |
| | SD | | | | 0.04935 | 61.70 | 319.25 | 0.54 | 1.42 |

## APPENDIX B5 - MPC /ɔ/

| No | /ɔ/ | Word | Meaning | Time | Duration | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | LC1 | gOstah | like | 14.695 | 0.28 | 555 | 1622 | 5.21 | 11.72 |
| 2 | LC1 | gOstah | like | 143.651 | 0.092 | 643 | 1613 | 5.94 | 11.69 |
| 3 | LC1 | abOh | kueh name | 239.148 | 0.231 | 534 | 923 | 5.03 | 8.01 |
| 4 | LC1 | gOstah | like | 278.434 | 0.256 | 610 | 1768 | 5.66 | 12.30 |
| 5 | LC1 | gOstah | like | 283.935 | 0.233 | 615 | 1455 | 5.70 | 11.00 |
| 6 | LC1 | gOstah | like | 288.961 | 0.164 | 619 | 1618 | 5.74 | 11.71 |
| 7 | LC1 | gOstah | like | 298.999 | 0.26 | 688 | 1547 | 6.29 | 11.41 |
| 8 | LC2 | dOs | two | 23.684144 | 0.131553714143756 | 440 | 1089 | 4.21 | 9.06 |
| 9 | LC2 | abOh | grandparent | 72.127191 | 0.090526568 8580101 | 455 | 853 | 4.34 | 7.52 |
| 10 | LC2 | abOh | grandparent | 91.157728 | 0.088694037 6640126 | 492 | 973 | 4.67 | 8.34 |
| 11 | LC2 | mpOku | a little | 96.049291 | 0.088090459 1473097 | 447 | 835 | 4.27 | 7.40 |
| 12 | LC2 | abOh | grandparent | 102.265494 | 0.107294009 909793 | 472 | 979 | 4.49 | 8.38 |
| 13 | LC2 | bOtah | put | 346.215675 | 0.079299353 0867534 | 616 | 1275 | 5.72 | 10.11 |
| 14 | LC2 | bOtak | put | 347.732161 | 0.071408088 2822827 | 580 | 1390 | 5.41 | 10.68 |
| 15 | LC2 | bOtah | put | 351.128396 | 0.081512154 2102588 | 623 | 1302 | 5.77 | 10.25 |
| 16 | LC2 | bOtal | put | 353.261269 | 0.088324165 607105 | 626 | 1374 | 5.80 | 10.61 |
| 17 | LC2 | bOtak | put | 354.963579 | 0.080151381 6278998 | 584 | 1522 | 5.45 | 11.30 |
| 18 | LC2 | pOdi | can | 363.566061 | 0.161667735 948072 | 463 | 1152 | 4.41 | 9.43 |
| 19 | LC2 | pOdi | can | 365.15051 | 0.110916434 405283 | 433 | 1178 | 4.14 | 9.58 |
| 20 | LC3 | bOs | you / your | 212.086165 | 0.027739900 899035800 | 592 | 1282 | 5.52 | 10.14 |
| 21 | LC3 | bOs | you / your | 308.545504 | 0.072440425 65270090 | 584 | 1097 | 5.45 | 9.11 |
| 22 | LC3 | bOsa | yours | 310.460289 | 0.041427056 88991550 | 582 | 1185 | 5.43 | 9.62 |
| 23 | LC3 | bOs | you / your | 351.779235 | 0.036019616 793964800 | 568 | 1228 | 5.32 | 9.85 |
| 24 | LC3 | bOs | you / your | 352.673873 | 0.099889155 89019600 | 463 | 1184 | 4.41 | 9.61 |
| 25 | LC3 | bOs | you / your | 368.470361 | 0.085836517 64445220 | 588 | 1205 | 5.48 | 9.73 |
| 26 | LC3 | bOs | you / your | 378.260355 | 0.128459559 8958730 | 513 | 897 | 4.85 | 7.83 |
| 27 | LC3 | bOs | you / your | 379.687922 | 0.079689649 03557210 | 621 | 889 | 5.76 | 7.77 |
| 28 | LC3 | bOsa | yours | 380.304466 | 0.058911364 62639680 | 502 | 1101 | 4.75 | 9.13 |
| 29 | LC3 | tOkah | knock / play | 394.419894 | 0.035750784 9064973 | 725 | 1230 | 6.58 | 9.87 |
| 30 | LC3 | mpOku | a little | 395.123137 | 0.057730801 93273470 | 586 | 937 | 5.47 | 8.10 |
| 31 | LC3 | mpOku | a little | 471.640127 | 0.081615832 96652000 | 596 | 929 | 5.55 | 8.05 |
| 32 | LC3 | tOkah | knock / play | 497.428986 | 0.025267625 252695300 | 607 | 1163 | 5.64 | 9.49 |
| 33 | LC3 | bOs | you / your | 566.792480 | 0.040755146 27447770 | 568 | 1159 | 5.32 | 9.47 |
| 34 | LC3 | bOs | you / your | 706.691789 | 0.066413113 81736160 | 535 | 908 | 5.03 | 7.91 |

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|---|---|---|---|---|---|---|---|---|---|
| 35 | LC3 | bOs | you / your | 712.549114 | 0.10203596853921200 | 588 | 909 | 5.48 | 7.91 |
| 36 | LC3 | bOs | you / your | 725.717687 | 0.11401412561394900 | 739 | 1416 | 6.69 | 10.81 |
| 37 | LC3 | bOs | you / your | 863.242812 | 0.3687306046563210 | 513 | 906 | 4.85 | 7.89 |
| 38 | LC3 | bOs | you / your | 863.806739 | 0.16661306492403600 | 476 | 888 | 4.52 | 7.77 |
| 39 | LC3 | bOs | you / your | 867.868532 | 0.11122298735699600 | 480 | 967 | 4.57 | 8.30 |
| 40 | LC3 | bOs | you / your | 933.764531 | 0.06035985716641790 0 | 516 | 1195 | 4.88 | 9.67 |
| 41 | LC4 | bOs | your | 45.378655 | 0.14164820525367400 | 606 | 1423 | 5.63 | 10.84 |
| 42 | LC4 | bOs | your | 8.694363 | 0.13847274055545 | 498 | 1142 | 4.72 | 9.38 |
| 43 | LC4 | pOdi | can | 180.691809 | 0.02315101872906670 0 | 550 | 1431 | 5.17 | 10.88 |
| 44 | LC4 | dOs | two | 215.23932 | 0.12097873716646700 | 530 | 1070 | 5.00 | 8.95 |
| 45 | LC4 | dOs | two | 219.627618 | 0.15560682973762100 | 496 | 934 | 4.71 | 8.08 |
| 46 | LC4 | dOs | teo | 232.808568 | 0.16847894437930200 | 561 | 1217 | 5.26 | 9.80 |
| 47 | LC4 | dOs | two | 243.498518 | 0.12864906247247600 | 508 | 954 | 4.81 | 8.21 |
| 48 | LC4 | dOs | two | 251.093969 | 0.24071950256217200 | 563 | 882 | 5.28 | 7.72 |
| 49 | LC4 | dOs | two | 255.279750 | 0.28099880706523100 | 605 | 950 | 5.62 | 8.19 |
| 50 | LC4 | dOs | two | 319.613676 | 0.2389255420719680 | 513 | 1000 | 4.85 | 8.51 |
| 51 | LC4 | tOkah | knock / play | 573.88252 | 0.03799081366332760 | 635 | 1154 | 5.87 | 9.44 |
| 52 | LC4 | angkOza | things | 581.651027 | 0.12755361685265100 | 642 | 934 | 5.92 | 8.08 |
| 53 | LC4 | dOh | already (dah pronounced as doh) | 583.988834 | 0.04633314985960620 | 553 | 1358 | 5.19 | 10.53 |
| 54 | LC4 | tOkah | knock / play | 595.273953 | 0.04203849278360390 | 768 | 1472 | 6.91 | 11.07 |
| 55 | LC4 | gOstah | like | 619.960493 | 0.08583591385661290 | 679 | 981 | 6.22 | 8.39 |
| 56 | LC4 | gOstah | like | 633.059901 | 0.09782207181933 7 | 728 | 1112 | 6.60 | 9.20 |
| 57 | LC4 | peskadOr | fishermen | 645.141851 | 0.15750413171247100 | 523 | 960 | 4.93 | 8.25 |
| 58 | LC4 | dOs | two | 657.481258 | 0.14740665467570 60 | 499 | 939 | 4.72 | 8.12 |
| 59 | LC4 | kOku | coconut | 703.749464 | 0.25307166922 99390 | 520 | 795 | 4.91 | 7.11 |
| 60 | LC4 | mpOku | a little | 715.341954 | 0.04040389779697760 | 596 | 922 | 5.55 | 8.00 |
| 61 | LC4 | gOstah | like | 735.261447 | 0.09758061971695040 | 616 | 937 | 5.72 | 8.10 |
| 62 | LC4 | gOstah | like | 744.589335 | 0.10190391466642300 | 750 | 1047 | 6.77 | 8.80 |
| 63 | LC4 | bOtah | put | 767.450635 | 0.07671773208 44894 | 596 | 1122 | 5.55 | 9.26 |
| 64 | LC4 | bOkeras | candlenut | 770.102107 | 0.09747644992489770 | 545 | 875 | 5.12 | 7.68 |
| 65 | LC4 | kOku | coconut | 774.744353 | 0.09441877933818430 | 407 | 699 | 3.91 | 6.38 |
| 66 | LC4 | kOku | coconut | 776.257473 | 0.12028072296050100 | 509 | 852 | 4.82 | 7.51 |

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|---|---|---|---|---|---|---|---|---|---|
| 67 | LC4 | repOstah | response | 886.562022 | 0.135644121 79584900 | 696 | 1404 | 6.35 | 10.75 |
| 68 | LC4 | angkOza | things | 892.694728 | 0.134962957 26508800 | 759 | 1116 | 6.84 | 9.22 |
| 69 | LC5 | pOdi | can | 68.058946 | 0.036214212 852527800 | 440 | 1538 | 4.21 | 11.37 |
| 70 | LC5 | mpOdi | cannot | 289.579776 | 0.061882923 46405430 | 535 | 1221 | 5.04 | 9.82 |
| 71 | LC5 | mpOdi | cannot | 361.630712 | 0.058439470 55257100 | 512 | 1172 | 4.84 | 9.55 |
| 72 | LC5 | pOdi | can | 374.090139 | 0.046076429 89094530 | 523 | 1259 | 4.93 | 10.02 |
| 73 | LC5 | mpOdi | cannot | 395.283516 | 0.068638881 07398000 | 495 | 1248 | 4.69 | 9.97 |
| 74 | LC5 | tOkah | get | 553.273671 | 0.039737711 260045200 | 696 | 1307 | 6.36 | 10.27 |
| 75 | LC5 | kOfi | coffee | 555.837922 | 0.170002419 44697300 | 649 | 915 | 5.98 | 7.95 |
| 76 | LC5 | kOfi | coffee | 558.864087 | 0.144961597 44544500 | 743 | 1030 | 6.72 | 8.70 |
| 77 | LC5 | tOkah | get | 575.250703 | 0.054191488 1835055 | 726 | 1356 | 6.59 | 10.52 |
| 78 | LC5 | tOkah | get | 581.365607 | 0.034498813 08199560 | 761 | 1315 | 6.85 | 10.31 |
| 79 | LC5 | bOs | yours | 591.748134 | 0.116255773 45125700 | 480 | 914 | 4.56 | 7.94 |
| 80 | LC5 | tOkah | get | 594.174150 | 0.043517125 78431940 | 657 | 1382 | 6.05 | 10.65 |
| 81 | LC5 | bOs | yours | 596.301313 | 0.111270269 48543100 | 517 | 985 | 4.89 | 8.41 |
| 82 | LC5 | bOs | yours | 657.894493 | 0.066915985 0071992 | 745 | 1792 | 6.73 | 12.39 |
| 83 | LC5 | bOka | mouth / words | 664.571831 | 0.159823236 300781 | 726 | 1069 | 6.59 | 8.94 |
| 84 | LC5 | tOkah | get | 669.509470 | 0.044162208 305806400 | 631 | 1258 | 5.84 | 10.02 |
| 85 | LC5 | bOka | mouth / words | 737.651624 | 0.087990476 36875910 | 604 | 990 | 5.61 | 8.45 |
| 86 | LC5 | bOs | yours | 747.242382 | 0.087485658 42302010 | 708 | 1009 | 6.45 | 8.57 |
| 87 | LC5 | dOs | two | 851.220176 | 0.158814881 6156260 | 463 | 1614 | 4.41 | 11.69 |
| 88 | LC5 | dOs | two | 859.926037 | 0.143906983 8895650 | 492 | 1153 | 4.66 | 9.44 |
| 89 | LC5 | tOkah | get | 865.543397 | 0.029536203 690099700 | 643 | 1373 | 5.94 | 10.61 |
| 90 | LC5 | pOdi | can | 926.369090 | 0.043475105 63900410 | 505 | 1208 | 4.78 | 9.75 |
| 91 | LC5 | dOs | two | 957.236732 | 0.112358086 63582200 | 446 | 932 | 4.26 | 8.07 |
| 92 | LC5 | angkOza | things | 958.027756 | 0.093794532 26267740 | 586 | 1239 | 5.47 | 9.92 |
| 93 | LC5 | bOtah | put | 960.480925 | 0.068797563 42641490 | 649 | 1252 | 5.98 | 9.98 |
| 94 | LC5 | bOs | yours | 962.628918 | 0.127717543 11313500 | 507 | 1031 | 4.79 | 8.71 |
| 95 | LC5 | bOtah | put | 999.620317 | 0.054215096 540815500 | 607 | 1177 | 5.64 | 9.57 |
| 96 | LC5 | bOtah | put | 1007.223714 | 0.064160362 58474380 | 553 | 1261 | 5.19 | 10.04 |
| 97 | LC5 | bOtah | put | 1010.097387 | 0.061366851 793764 | 655 | 1352 | 6.03 | 10.50 |
| 98 | LC5 | bOtah | put | 1014.030025 | 0.051185843 123903400 | 630 | 1200 | 5.83 | 9.70 |
| 99 | LC5 | bOtah | put | 1017.481261 | 0.090482225 1901578 | 608 | 1106 | 5.65 | 9.16 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 100 | LC5 | bOtah | put | 1043.976241 | 0.059726650715219900 | 627 | 1372 | 5.81 | 10.60 |
| 101 | LC5 | mpOku | a little | 1051.469989 | 0.035595335 31733900 | 561 | 1766 | 5.26 | 12.29 |
| 102 | LC5 | bOttah | put | 1053.868310 | 0.041735013 15108300 | 607 | 1551 | 5.64 | 11.43 |
| 103 | LC5 | bOtah | put | 1061.247205 | 0.043299676 333163000 | 517 | 2103 | 4.88 | 13.43 |
| 104 | LC5 | bOtah | put | 1069.535142 | 0.054758281 8248884 | 572 | 1324 | 5.35 | 10.36 |
| 105 | LC5 | bOtak | put / add | 1071.306787 | 0.059263010 95655620 | 602 | 1280 | 5.60 | 10.13 |
| 106 | LC5 | bOtah | put | 1099.581638 | 0.071019808 59920330 | 633 | 1263 | 5.86 | 10.04 |
| 107 | LC5 | bOkeras | candlenut | 1110.579936 | 0.071054000 54501840 | 605 | 929 | 5.62 | 8.05 |
| | | Ave | | | 0.10334 | 580.37 | 1178.28 | 5.40 | 9.46 |
| | | SD | | | 0.06564 | 85.45 | 252.04 | 0.71 | 1.35 |

## APPENDIX B6 - MPC /a/

| No | /a/ | Word | Meaning | Time | Duration | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | LC1 | sAtenta | sixty | 25.596193 | 0.0840455142056236 | 700 | 1838 | 6.39 | 12.55 |
| 2 | LC1 | sAtenta | sixty | 27.105674 | 0.0778107557751397 | 738 | 1992 | 6.68 | 13.08 |
| 3 | LC1 | pApiah | speak | 41.608764 | 0.0586677914032023 | 713 | 1574 | 6.48 | 11.52 |
| 4 | LC1 | ngkA | no | 53.202174 | 0.202217135201614 | 832 | 1758 | 7.37 | 12.26 |
| 5 | LC1 | pApiah | speak | 57.321805 | 0.0474808805762734 | 715 | 1477 | 6.51 | 11.10 |
| 6 | LC1 | pApiah | speak | 60.693166 | 0.0552244104521336 | 735 | 1548 | 6.66 | 11.41 |
| 7 | LC1 | ngkA | no | 65.11654 | 0.157491154159104 | 804 | 1918 | 7.17 | 12.83 |
| 8 | LC1 | ngkA | no | 93.924661 | 0.220229263473811 | 658 | 1945 | 6.05 | 12.92 |
| 9 | LC1 | kAkeli | at | 97.161793 | 0.100130632817738 | 678 | 1887 | 6.21 | 12.72 |
| 10 | LC1 | fikAh | stay | 99.673574 | 0.332997843066622 | 857 | 1588 | 7.55 | 11.58 |
| 11 | LC1 | pApiah | speak | 101.302922 | 0.0623858265137045 | 713 | 1568 | 6.49 | 11.50 |
| 12 | LC1 | sAbeh | know | 119.151805 | 0.0805575391950129 | 661 | 1876 | 6.08 | 12.69 |
| 13 | LC1 | tAbeng | just coming | 159.658524 | 0.0491948829606201 | 548 | 1883 | 5.14 | 12.71 |
| 14 | LC1 | gostAh | like | 181.511434 | 0.412442214925477 | 831 | 1871 | 7.36 | 12.67 |
| 15 | LC1 | bAzar | bazaar | 228.831459 | 0.109926746282895 | 783 | 1902 | 7.01 | 12.78 |
| 16 | LC1 | kAh | after | 236.117219 | 0.125997659090274 | 770 | 1901 | 6.92 | 12.78 |
| 17 | LC1 | bAzar | bazaar | 238.243228 | 0.122159490881813 | 758 | 1841 | 6.83 | 12.57 |
| 18 | LC1 | fAzeh | do | 241.251267 | 0.102992503774999 | 694 | 1886 | 6.34 | 12.72 |
| 19 | LC1 | judAh | help | 243.160281 | 0.101152938013371 | 782 | 1922 | 7.01 | 12.84 |
| 20 | LC1 | dAh | give | 247.882006 | 0.0850499406435858 | 748 | 1966 | 6.75 | 12.99 |
| 21 | LC1 | sAbdu | saturday | 271.086551 | 0.136721490205389 | 983 | 1735 | 8.40 | 12.17 |
| 22 | LC1 | kAza | home | 278.741269 | 0.186035724204203 | 812 | 1986 | 7.23 | 13.06 |
| 23 | LC1 | kAza | home | 306.463763 | 0.293098709212927 | 903 | 1837 | 7.87 | 12.55 |
| 24 | LC1 | kA | here | 308.414422 | 0.107957966110575 | 733 | 1482 | 6.64 | 11.12 |
| 25 | LC1 | kAza | home | 313.037535 | 0.162735172127043 | 893 | 1924 | 7.80 | 12.85 |
| 26 | LC1 | pAdikumih | return to eat | 315.242384 | 0.0644252565486454 | 726 | 1997 | 6.59 | 13.09 |
| 27 | LC1 | fAzeh | do | 330.539865 | 0.12348206215421 | 651 | 1896 | 6.00 | 12.76 |
| 28 | LC1 | fAzeh | do | 354.354372 | 0.134305353351579 | 678 | 1813 | 6.21 | 12.46 |
| 29 | LC1 | fAzeh | do | 357.780162 | 0.0648878986981458 | 594 | 1965 | 5.53 | 12.99 |
| 30 | LC1 | karipAp | curry puff | 358.381623 | 0.0985796922529403 | 905 | 1670 | 7.88 | 11.92 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 31 | LC1 | gostAh | like | 376.928231 | 0.065499008 1455935 | 733 | 1857 | 6.64 | 12.62 |
| 32 | LC1 | gostAh | like | 386.823623 | 0.160365379 831603 | 782 | 1808 | 7.01 | 12.45 |
| 33 | LC1 | gostAh | like | 394.491272 | 0.112422005 679548 | 741 | 1739 | 6.70 | 12.19 |
| 34 | LC1 | chA | tea | 403.954411 | 0.197092109 874632 | 963 | 1654 | 8.27 | 11.86 |
| 35 | LC1 | ngkA | no | 420.390442 | 0.153582569 428977 | 780 | 1880 | 7.00 | 12.70 |
| 36 | LC1 | sAbontadi | their wish | 448.363984 | 0.056273059 6582242 | 603 | 1864 | 5.61 | 12.65 |
| 37 | LC1 | bontAdi | wish | 448.879413 | 0.158477003 457733 | 869 | 1979 | 7.64 | 13.04 |
| 38 | LC1 | pApiah | speak | 453.247784 | 0.046155464 0381792 | 735 | 1572 | 6.66 | 11.51 |
| 39 | LC1 | pApiah | speak | 476.300208 | 0.061385887 6943709 | 778 | 1598 | 6.98 | 11.62 |
| 30 | LC1 | gostAh | speak | 484.421667 | 0.178412331 030813 | 859 | 1804 | 7.56 | 12.43 |
| 41 | LC1 | pApiah | speak | 504.708148 | 0.048621556 9300725 | 754 | 1515 | 6.80 | 11.27 |
| 42 | LC1 | pApiah | speak | 537.818298 | 0.069255854 4378699 | 837 | 1526 | 7.41 | 11.32 |
| 43 | LC1 | pApiah | speak | 543.257622 | 0.044033558 2334228 | 728 | 1489 | 6.60 | 11.15 |
| 44 | LC1 | fAzeh | do | 567.260446 | 0.116679195 309189 | 811 | 1767 | 7.22 | 12.29 |
| 45 | LC2 | idAdi | age | 22.626582 | 0.135115210 271966 | 819 | 1715 | 7.28 | 12.10 |
| 46 | LC2 | sAtenta | sixty | 23.030818 | 0.071409005 6237104 | 762 | 1728 | 6.86 | 12.15 |
| 47 | LC2 | fikAh | live | 27.571272 | 0.120368629 352097 | 706 | 1432 | 6.44 | 10.89 |
| 48 | LC2 | kAza | home | 42.139397 | 0.184514759 305664 | 806 | 1673 | 7.19 | 11.93 |
| 49 | LC2 | jA | already | 51.399897 | 0.044013939 6527428 | 518 | 1955 | 4.90 | 12.96 |
| 50 | LC2 | idAdi | age | 54.716345 | 0.144238200 9078 | 798 | 1818 | 7.13 | 12.48 |
| 51 | LC2 | pApiah | speak | 72.332597 | 0.086796395 8440612 | 745 | 1528 | 6.73 | 11.32 |
| 52 | LC2 | idAdi | age | 87.61043 | 0.172989898 763319 | 791 | 1754 | 7.08 | 12.24 |
| 53 | LC2 | jA | already | 89.731761 | 0.069242480 1355997 | 484 | 1818 | 4.59 | 12.48 |
| 54 | LC2 | pApiah | speak | 91.362041 | 0.074439638 7537165 | 644 | 1459 | 5.94 | 11.01 |
| 55 | LC2 | jA | already | 94.325048 | 0.196806068 235958 | 600 | 1645 | 5.58 | 11.82 |
| 56 | LC2 | sAbeh | know | 94.604386 | 0.097768175 8333517 | 790 | 1529 | 7.07 | 11.33 |
| 57 | LC2 | pApiah | speak | 94.987047 | 0.075584507 9458339 | 701 | 1525 | 6.40 | 11.31 |
| 58 | LC2 | pApiah | speak | 102.944951 | 0.089242174 1192919 | 692 | 1624 | 6.32 | 11.73 |
| 59 | LC2 | kAza | home | 104.49585 | 0.156202344 944546 | 899 | 1588 | 7.84 | 11.58 |
| 60 | LC2 | pApiah | speak | 105.027783 | 0.092877069 9670167 | 791 | 1431 | 7.08 | 10.88 |
| 61 | LC2 | pApiah | speak | 117.614037 | 0.071011242 2495399 | 707 | 1434 | 6.44 | 10.90 |
| 62 | LC2 | ngkA | no | 146.199067 | 0.048202655 7785673 | 511 | 1960 | 4.83 | 12.97 |
| 63 | LC2 | sAbeh | know | 146.370473 | 0.109543341 895858 | 903 | 1734 | 7.87 | 12.17 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 64 | LC2 | ngkA | no | 147.868831 | 0.021706380 7957345 | 443 | 1688 | 4.24 | 11.99 |
| 65 | LC2 | pApiah | speak | 148.224208 | 0.073955554 8570934 | 789 | 1673 | 7.06 | 11.93 |
| 66 | LC2 | pApiah | speak | 155.890578 | 0.080156467 3809878 | 720 | 1507 | 6.54 | 11.23 |
| 67 | LC2 | kAzamintu | wedding | 166.310227 | 0.127955669 859858 | 667 | 1611 | 6.13 | 11.68 |
| 68 | LC2 | sestA | sixth | 170.252323 | 0.142128973 93341 | 593 | 1671 | 5.53 | 11.92 |
| 69 | LC2 | sestAfera | Friday | 171.867339 | 0.034570342 8723425 | 451 | 1669 | 4.31 | 11.92 |
| 70 | LC2 | sAbdu | Saturday | 177.118726 | 0.169879840 722473 | 958 | 1499 | 8.24 | 11.20 |
| 71 | LC2 | sestAfera | friday | 184.298017 | 0.050051272 6178783 | 496 | 1790 | 4.70 | 12.38 |
| 72 | LC2 | sAbdu | Saturday | 188.064725 | 0.109566729 917361 | 986 | 1559 | 8.42 | 11.46 |
| 73 | LC2 | kAzamintu | wedding | 188.467854 | 0.099221199 4905858 | 668 | 1644 | 6.14 | 11.81 |
| 74 | LC2 | bAtatə | potatoes | 207.214972 | 0.089099820 4322955 | 800 | 1647 | 7.14 | 11.82 |
| 75 | LC2 | batAtə | potatoes | 207.431121 | 0.098999800 4802999 | 823 | 1702 | 7.31 | 12.04 |
| 76 | LC2 | chA | tea | 212.622422 | 0.180381160 724181 | 826 | 1598 | 7.33 | 11.62 |
| 77 | LC2 | kAza | home | 232.345149 | 0.141675101 910124 | 830 | 1578 | 7.36 | 11.54 |
| 78 | LC2 | kazA | home | 232.68955 | 0.260980450 887047 | 788 | 1512 | 7.06 | 11.25 |
| 79 | LC2 | ngkA | no | 273.813661 | 0.051057600 3108554 | 497 | 1744 | 4.71 | 12.21 |
| 80 | LC2 | pAdri | priest | 298.786683 | 0.126934818 283814 | 891 | 1486 | 7.79 | 11.14 |
| 81 | LC2 | sAfrang | saffron | 328.818711 | 0.116963354 462882 | 858 | 1647 | 7.56 | 11.83 |
| 82 | LC2 | kAbah | then after | 345.705894 | 0.063439482 4693914 | 703 | 1531 | 6.41 | 11.34 |
| 83 | LC2 | kabAh | then after | 345.952855 | 0.183521360 000725 | 626 | 1455 | 5.79 | 11.00 |
| 84 | LC2 | botAh | put | 346.464902 | 0.163130097 778492 | 795 | 1625 | 7.10 | 11.74 |
| 85 | LC2 | jA | already | 350.434011 | 0.085655188 2814074 | 466 | 2166 | 4.44 | 13.61 |
| 86 | LC2 | kAbəh | then after | 352.948455 | 0.079123731 6896627 | 668 | 1563 | 6.14 | 11.47 |
| 87 | LC2 | atApə | potatoes? | 353.738772 | 0.128806074 843681 | 944 | 1599 | 8.15 | 11.63 |
| 88 | LC3 | fikAh | stay | 129.069953 | 0.156787276 10483600 | 817 | 1861 | 7.26 | 12.63 |
| 89 | LC3 | pApiah | speak | 141.242573 | 0.036978795 31415540 | 842 | 1435 | 7.44 | 10.90 |
| 90 | LC3 | kAzah | marry | 147.774950 | 0.101299274 38714500 | 835 | 1683 | 7.40 | 11.97 |
| 91 | LC3 | kazAh | marry | 148.070880 | 0.191216607 83187600 | 877 | 1717 | 7.69 | 12.10 |
| 92 | LC3 | sAbeh | know | 157.093932 | 0.059786325 1084334 | 932 | 1538 | 8.07 | 11.37 |
| 93 | LC3 | pApiah | speak | 187.848513 | 0.063757839 46188560 | 853 | 1400 | 7.52 | 10.74 |
| 94 | LC3 | pApiah | speak | 189.046364 | 0.058596032 29319530 | 828 | 1381 | 7.34 | 10.64 |
| 95 | LC3 | sAbeh | know | 212.224864 | 0.054158854 13620460 | 837 | 1983 | 7.41 | 13.05 |
| 96 | LC3 | pApiah | speak | 217.977929 | 0.094192869 06245360 | 970 | 1517 | 8.31 | 11.28 |

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|---|---|---|---|---|---|---|---|---|---|
| 97 | LC3 | kAza | home | 219.921804 | 0.11963358130918800 | 909 | 1745 | 7.91 | 12.21 |
| 98 | LC3 | pApiah | speak | 223.537517 | 0.05376502112727620 0 | 877 | 1468 | 7.69 | 11.06 |
| 99 | LC3 | kAbah | then after | 285.983010 | 0.05754576218242850 | 718 | 1665 | 6.52 | 11.90 |
| 100 | LC3 | kabAh | then after | 286.244432 | 0.27786382310927 10 | 683 | 1696 | 6.26 | 12.02 |
| 101 | LC3 | kAzah | marry | 321.041112 | 0.09634760512295 77 | 937 | 1830 | 8.10 | 12.52 |
| 102 | LC3 | kazAh | marry | 321.208574 | 0.04702680726239810 | 953 | 1860 | 8.20 | 12.63 |
| 103 | LC3 | kAza | home | 373.383657 | 0.25781373273775 9 | 1114 | 1617 | 9.21 | 11.70 |
| 104 | LC3 | mpustAh | let | 392.568115 | 0.09003474610153720 | 786 | 1539 | 7.04 | 11.37 |
| 105 | LC3 | tokAh | knock /play | 394.514288 | 0.00909449791487305 0 | 978 | 1463 | 8.37 | 11.03 |
| 106 | LC3 | kAbah | then after | 397.807509 | 0.04484044275022820 | 797 | 1488 | 7.12 | 11.15 |
| 107 | LC3 | kabAh | then after | 397.917572 | 0.03532883368200150 | 644 | 1416 | 5.94 | 10.81 |
| 108 | LC3 | pAgah | pay | 400.331863 | 0.03504480592647 5000 | 589 | 2344 | 5.50 | 14.11 |
| 109 | LC3 | pagAh | pay | 400.528990 | 0.08104111370499820 | 909 | 1528 | 7.91 | 11.32 |
| 110 | LC3 | ngkA | no | 426.969176 | 0.05537774225138040 | 628 | 1860 | 5.81 | 12.63 |
| 111 | LC3 | sAbeh | know | 427.129480 | 0.10026285966552310 | 906 | 1653 | 7.89 | 11.85 |
| 112 | LC3 | pApiah | speak | 427.432636 | 0.05284183932900530 0 | 800 | 1540 | 7.14 | 11.37 |
| 113 | LC3 | pApiah | speak | 430.626053 | 0.04511454100355650 0 | 861 | 1467 | 7.58 | 11.05 |
| 114 | LC3 | kAbah | then after | 431.784875 | 0.02342594318656670 0 | 691 | 1354 | 6.32 | 10.51 |
| 115 | LC3 | kabAh | then after | 431.920063 | 0.05954093893240040 | 760 | 1675 | 6.84 | 11.94 |
| 116 | LC3 | pAderi | priest | 432.445705 | 0.04060084318160760 0 | 1021 | 1554 | 8.64 | 11.44 |
| 117 | LC3 | kAza | home | 447.846958 | 0.11762118378027300 | 912 | 1759 | 7.93 | 12.26 |
| 118 | LC3 | fAzeh | do | 449.851594 | 0.05036914368258750 | 801 | 1647 | 7.15 | 11.83 |
| 119 | LC3 | kAza | home | 450.162967 | 0.08929075471002080 | 867 | 1661 | 7.62 | 11.88 |
| 120 | LC3 | fAzeh | do | 478.499381 | 0.06207905651461940 0 | 860 | 1706 | 7.57 | 12.06 |
| 121 | LC3 | fAzeh | do | 480.523888 | 0.14179576178980800 | 842 | 1604 | 7.44 | 11.65 |
| 122 | LC3 | tokAh | knock/ play | 497.574275 | 0.04000707331670130 | 653 | 1032 | 6.02 | 8.71 |
| 123 | LC3 | fAzeh | do | 508.883882 | 0.08653655163737990 | 811 | 1602 | 7.22 | 11.64 |
| 124 | LC3 | pApiah | speak | 535.972219 | 0.09527868881616540 | 954 | 1535 | 8.21 | 11.36 |
| 125 | LC3 | pApiah | speak | 537.065019 | 0.05708515567391710 | 845 | 1376 | 7.46 | 10.62 |
| 126 | LC3 | sAbeh | know | 592.683563 | 0.07719286946905870 | 949 | 1591 | 8.18 | 11.60 |
| 127 | LC3 | pApiah | speak | 692.958510 | 0.08876097432346340 | 942 | 1510 | 8.13 | 11.24 |
| 128 | LC3 | pApiah | speak | 706.889213 | 0.04877213045972440 0 | 855 | 1425 | 7.53 | 10.85 |
| 129 | LC3 | pApiah | speak | 713.323915 | 0.07989898612436260 | 996 | 1674 | 8.48 | 11.93 |

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|---|---|---|---|---|---|---|---|---|---|
| 130 | LC3 | pApiah | speak | 715.102262 | 0.045498908 27661330 | 844 | 1564 | 7.46 | 11.48 |
| 131 | LC3 | pApiah | speak | 717.722682 | 0.050925312 929166500 | 868 | 1454 | 7.63 | 10.99 |
| 132 | LC3 | pApiah | speak | 726.805828 | 0.052529678 42284310 | 953 | 1543 | 8.21 | 11.39 |
| 133 | LC3 | fikAh | stay | 825.061800 | 0.095976424 06072280 | 871 | 1758 | 7.65 | 12.26 |
| 134 | LC3 | botAh | put | 904.212290 | 0.061758767 44089240 | 929 | 1701 | 8.04 | 12.04 |
| 135 | LC3 | sAbeh | know | 905.502366 | 0.076018989 88264110 | 1006 | 2019 | 8.55 | 13.17 |
| 136 | LC3 | pAderi | priest | 937.835752 | 0.119607 | 871 | 1839 | 7.65 | 12.56 |
| 137 | LC3 | lebAh | | 938.377890 | 0.033774037 29268740 | 645 | 1505 | 5.95 | 11.22 |
| 138 | LC3 | kAbah | then after | 949.204714 | 0.022968699 08411740 | 609 | 1696 | 5.66 | 12.02 |
| 139 | LC3 | kabAh | then after | 949.301276 | 0.051093636 73830100 | 532 | 1482 | 5.01 | 11.12 |
| 140 | LC3 | fikAh | stay | 950.047950 | 0.028926351 35481210 | 553 | 2150 | 5.19 | 13.57 |
| 141 | LC3 | bAtatə | potatoes | 954.274545 | 0.074204358 12719010 | 909 | 1637 | 7.91 | 11.79 |
| 142 | LC3 | batAtə | potatoes | 954.511803 | 0.123023014 789851 | 931 | 1799 | 8.06 | 12.41 |
| 143 | LC3 | kAbah | then after | 960.592649 | 0.017893014 880314700 | 605 | 981 | 5.62 | 8.39 |
| 144 | LC3 | kabAh | then after | 960.717900 | 0.064282312 7182055 | 596 | 596 | 5.55 | 5.55 |
| 145 | LC3 | fAzeh | do | 962.930109 | 0.070191814 49800270 | 767 | 1745 | 6.90 | 12.21 |
| 146 | LC4 | idAdi | age | 62.783648 | 0.236527130 8391710 | 877 | 1771 | 7.69 | 12.31 |
| 147 | LC4 | jA | already | 63.36097 | 0.200729609 35312500 | 573 | 1831 | 5.36 | 12.53 |
| 148 | LC4 | fikAh | stay | 113.350533 | 0.138437673 59381300 | 834 | 1749 | 7.39 | 12.23 |
| 149 | LC4 | pAdri | priest | 113.903128 | 0.070116270 64792950 | 773 | 1568 | 6.94 | 11.50 |
| 150 | LC4 | jA | already | 120.758259 | 0.056759732 81614690 | 589 | 1912 | 5.49 | 12.81 |
| 151 | LC4 | pApiah | speak | 138.535417 | 0.053864605 97810580 | 696 | 1425 | 6.35 | 10.86 |
| 152 | LC4 | jA | already | 145.425257 | 0.068188028 53692320 | 541 | 2134 | 5.09 | 13.52 |
| 153 | LC4 | kAzah | married | 145.618973 | 0.156522520 0506860 | 913 | 1664 | 7.94 | 11.89 |
| 154 | LC4 | kazAh | married | 145.970761 | 0.328542319 3142950 | 901 | 1550 | 7.86 | 11.42 |
| 155 | LC4 | pApiah | speak | 147.143880 | 0.069840277 40497820 | 733 | 1360 | 6.64 | 10.54 |
| 156 | LC4 | pApiah | speak | 150.789756 | 0.054961744 539667700 | 748 | 1455 | 6.76 | 11.00 |
| 157 | LC4 | pApiah | speak | 154.21135 | 0.056007510 48959300 | 675 | 1560 | 6.19 | 11.46 |
| 158 | LC4 | kAbah | then after | 155.959851 | 0.075750792 08558580 | 654 | 1679 | 6.02 | 11.96 |
| 159 | LC4 | pApiah | speak | 158.546463 | 0.035904428 07055180 | 686 | 1278 | 6.28 | 10.12 |
| 160 | LC4 | pApiah | speak | 162.682283 | 0.048583302 95058980 | 726 | 1320 | 6.59 | 10.34 |
| 161 | LC4 | pApiah | speak | 165.035164 | 0.050840982 54931750 | 699 | 1507 | 6.38 | 11.23 |
| 162 | LC4 | ngkA | no | 170.19047 | 0.040224716 040313500 | 529 | 1724 | 4.98 | 12.13 |

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|---|---|---|---|---|---|---|---|---|---|
| 163 | LC4 | sAbeh | know | 170.314018 | 0.061773671061899900 | 736 | 1577 | 6.66 | 11.54 |
| 164 | LC4 | ngkA | no | 173.54232 | 0.07637675794669010 | 743 | 1739 | 6.71 | 12.19 |
| 165 | LC4 | ngkA | no | 173.979837 | 0.04402874763604810 | 700 | 1830 | 6.39 | 12.52 |
| 166 | LC4 | sAbeh | know | 174.092911 | 0.04903201441285890 | 744 | 1682 | 6.72 | 11.97 |
| 167 | LC4 | jA | already | 178.607057 | 0.03159600685779650 | 540 | 1769 | 5.08 | 12.30 |
| 168 | LC4 | pApiah | speak | 180.92122 | 0.05859236160551970 | 748 | 1700 | 6.75 | 12.04 |
| 169 | LC4 | yosA | my / mine | 211.946033 | 0.04633112381353040 | 550 | 1638 | 5.16 | 11.79 |
| 170 | LC4 | kAbah | then after | 225.107065 | 0.03484716338991230 | 690 | 1755 | 6.31 | 12.25 |
| 171 | LC4 | kabAh | then after | 225.232941 | 0.06684966038065450 | 591 | 1920 | 5.51 | 12.84 |
| 172 | LC4 | jA | already | 242.481989 | 0.04936122796755170 | 556 | 2153 | 5.22 | 13.58 |
| 173 | LC4 | kAzah | married | 242.624158 | 0.10315936626142300 | 846 | 1829 | 7.47 | 12.52 |
| 174 | LC4 | kazAh | married | 242.861179 | 0.16824801402160000 | 849 | 1607 | 7.49 | 11.66 |
| 175 | LC4 | kAzah | married | 244.060428 | 0.11066421921887600 | 868 | 1694 | 7.63 | 12.01 |
| 176 | LC4 | kazAh | married | 244.300201 | 0.14460124644600100 | 814 | 1562 | 7.25 | 11.47 |
| 177 | LC4 | tAfikah | just / already staying | 246.285383 | 0.03971465184164910 | 555 | 1979 | 5.21 | 13.04 |
| 178 | LC4 | tAfikah | just / already staying | 258.832156 | 0.43353333262228900 | 719 | 1709 | 6.53 | 12.07 |
| 179 | LC4 | fikAh | stay | 259.427987 | 0.07796896538354760 | 772 | 1824 | 6.93 | 12.50 |
| 180 | LC4 | jA | already | 259.553217 | 0.04462720515886080 | 628 | 2049 | 5.81 | 13.26 |
| 181 | LC4 | kAzah | married | 259.709735 | 0.09895597665655490 | 822 | 1282 | 7.30 | 10.14 |
| 182 | LC4 | kazAh | married | 259.945807 | 0.19079747133122300 | 837 | 1526 | 7.41 | 11.32 |
| 183 | LC4 | tA | is /going to | 260.185847 | 0.03464832510627500 0 | 609 | 1799 | 5.66 | 12.41 |
| 184 | LC4 | fikAh | stay | 260.463642 | 0.04923709357206010 0 | 652 | 1835 | 6.01 | 12.54 |
| 185 | LC4 | fikAh | stay | 271.518423 | 0.04373403836132180 0 | 724 | 2104 | 6.57 | 13.43 |
| 186 | LC4 | pAdri | priest | 272.937087 | 0.08088062789818200 | 757 | 1578 | 6.82 | 11.54 |
| 187 | LC4 | kAbah | then after | 275.056081 | 0.05209724747618340 0 | 601 | 1794 | 5.60 | 12.39 |
| 188 | LC4 | kAbah | then after | 281.073388 | 0.02662405273889590 0 | 574 | 1675 | 5.37 | 11.94 |
| 189 | LC4 | kAza | home | 282.674897 | 0.20206237445751200 | 1005 | 1757 | 8.55 | 12.26 |
| 190 | LC4 | jA | already | 283.466067 | 0.07793697169927330 | 564 | 1960 | 5.29 | 12.97 |
| 191 | LC4 | jA | already | 284.456155 | 0.16886343866817400 | 703 | 1712 | 6.41 | 12.08 |
| 192 | LC4 | kAbah | then after | 285.7098 | 0.04219383666181962 | 653 | 1706 | 6.02 | 12.06 |
| 193 | LC4 | jA | already | 286.835477 | 0.03001951254043430 0 | 452 | 2194 | 4.31 | 13.70 |
| 194 | LC4 | kAbah | then after | 296.019609 | 0.04184771848537140 | 656 | 1862 | 6.04 | 12.64 |
| 195 | LC4 | jA | already | 296.672839 | 0.02789031297328390 0 | 461 | 2119 | 4.39 | 13.48 |

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|---|---|---|---|---|---|---|---|---|---|
| 196 | LC4 | fAzeh | do | 300.687205 | 0.040260718 73465750 | 675 | 1713 | 6.19 | 12.09 |
| 197 | LC4 | fAzeh | do | 302.774135 | 0.050183941 25181660 | 620 | 1939 | 5.75 | 12.90 |
| 198 | LC4 | jA | already | 328.836766 | 0.049326675 924760400 | 556 | 1981 | 5.21 | 13.04 |
| 199 | LC4 | jA | already | 330.03462 | 0.130604351 9184640 | 660 | 1905 | 6.07 | 12.79 |
| 200 | LC4 | jA | already | 369.81915 | 0.037898794 28580890 | 611 | 2068 | 5.67 | 13.32 |
| 201 | LC4 | pApiah | speak | 370.197638 | 0.048268475 78840440 | 866 | 1568 | 7.62 | 11.50 |
| 202 | LC4 | kAzə | home | 372.805374 | 0.087447741 1848602 | 864 | 1708 | 7.60 | 12.07 |
| 203 | LC4 | pApiah | speak | 373.873145 | 0.056151211 876567700 | 710 | 1444 | 6.46 | 10.94 |
| 204 | LC4 | pApiah | speak | 375.583125 | 0.048095476 1413841 | 698 | 1175 | 6.37 | 9.56 |
| 205 | LC4 | pApiah | speak | 377.164894 | 0.040065100 202980400 | 673 | 1239 | 6.18 | 9.92 |
| 206 | LC4 | kAza | home | 378.897866 | 0.144682897 63868800 | 1022 | 1651 | 8.65 | 11.84 |
| 207 | LC4 | pApiah | speak | 379.475923 | 0.071747574 66589200 | 714 | 1409 | 6.50 | 10.78 |
| 208 | LC4 | ngkA | no | 386.454102 | 0.036443453 01768230 | 636 | 1315 | 5.88 | 10.32 |
| 209 | LC4 | pApiah | speak | 386.580321 | 0.047998694 2184496 | 663 | 1410 | 6.09 | 10.78 |
| 210 | LC4 | ngkA | no | 388.268358 | 0.011410285 974591300 | 601 | 1290 | 5.59 | 10.19 |
| 211 | LC4 | pApiah | speak | 389.162012 | 0.055543901 65366390 | 757 | 1228 | 6.82 | 9.85 |
| 212 | LC4 | jA | already | 403.586757 | 0.077840453 37098180 | 579 | 690 | 5.41 | 6.31 |
| 213 | LC4 | pAdri | priest | 404.808742 | 0.056227342 21418570 | 779 | 1690 | 6.98 | 12.00 |
| 214 | LC4 | tA | is /going to | 413.941917 | 0.018850430 165912300 | 1142 | 1521 | 9.37 | 11.29 |
| 215 | LC4 | jA | already | 422.313236 | 0.035528596 12358360 | 438 | 2004 | 4.19 | 13.12 |
| 216 | LC4 | kAbah | then after | 426.730427 | 0.066576762 07640860 | 802 | 1626 | 7.16 | 11.74 |
| 217 | LC4 | kabAh | then after | 426.904434 | 0.177538032 20387 | 841 | 1563 | 7.44 | 11.48 |
| 218 | LC4 | jA | already | 427.745872 | 0.043236093 7271028 | 511 | 2059 | 4.83 | 13.29 |
| 219 | LC4 | kAbah | then after | 432.097657 | 0.031007375 632043500 | 724 | 1369 | 6.57 | 10.59 |
| 220 | LC4 | kA di tras | at | 461.563178 | 0.096842473 40703680 | 666 | 1959 | 6.12 | 12.97 |
| 221 | LC4 | jA | already | 465.444606 | 0.230561280 01911700 | 780 | 1651 | 6.99 | 11.84 |
| 222 | LC4 | jA | already | 467.077577 | 0.041595510 17966120 | 549 | 2037 | 5.15 | 13.22 |
| 223 | LC4 | jA | already | 481.67935 | 0.036280653 218682300 | 546 | 2063 | 5.13 | 13.30 |
| 224 | LC4 | jA | already | 509.061197 | 0.042397950 81406330 | 503 | 2045 | 4.77 | 13.25 |
| 225 | LC4 | tA | is /going to | 536.563336 | 0.028370331 490236800 | 638 | 1617 | 5.89 | 11.71 |
| 226 | LC4 | kAbah | then after | 541.032344 | 0.048761212 63225740 | 701 | 1673 | 6.40 | 11.93 |
| 227 | LC4 | kabAh | then after | 541.36067 | 0.429098671 16418400 | 680 | 1677 | 6.23 | 11.95 |
| 228 | LC4 | sAkumih | their food | 547.254312 | 0.028167447 839905400 | 646 | 1734 | 5.96 | 12.17 |

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|---|---|---|---|---|---|---|---|---|---|
| 229 | LC4 | kAbah | then after | 548.464355 | 0.075705081 25536430 | 805 | 1608 | 7.18 | 11.66 |
| 230 | LC4 | kAza | home | 550.303493 | 0.180473657 44564600 | 934 | 1575 | 8.08 | 11.53 |
| 231 | LC4 | kazA | home | 550.517314 | 0.093866926 19091260 | 685 | 2070 | 6.27 | 13.33 |
| 232 | LC4 | ngkA | no | 552.741278 | 0.051991518 999670900 | 623 | 1187 | 5.77 | 9.63 |
| 233 | LC4 | kAza | home | 554.879791 | 0.144405938 22541800 | 956 | 1420 | 8.23 | 10.83 |
| 234 | LC4 | butikA | shop | 559.1184 | 0.041221963 205089200 | 530 | 2122 | 4.99 | 13.49 |
| 235 | LC4 | kAza | home | 565.397823 | 0.148780971 18310100 | 957 | 1659 | 8.23 | 11.88 |
| 236 | LC4 | kazA | home | 565.580485 | 0.045665446 60076490 | 600 | 1740 | 5.58 | 12.19 |
| 237 | LC4 | kAza | home | 568.271777 | 0.135879220 4449630 | 866 | 1874 | 7.61 | 12.68 |
| 238 | LC4 | kAbah | then after | 569.721985 | 0.065890008 65255910 | 782 | 1684 | 7.01 | 11.98 |
| 239 | LC4 | kAbah | then after | 570.476643 | 0.069557438 6223825 | 821 | 1677 | 7.29 | 11.95 |
| 240 | LC4 | kabAh | then after | 570.795632 | 0.428904653 4756840 | 762 | 1677 | 6.86 | 11.94 |
| 241 | LC4 | jA | already | 571.298286 | 0.055535217 804731500 | 458 | 2134 | 4.37 | 13.52 |
| 242 | LC4 | tokAh | knock/ play | 573.978958 | 0.028493110 24749570 | 604 | 1165 | 5.62 | 9.51 |
| 243 | LC4 | kAbah | then after | 575.595365 | 0.027708311 571473100 | 638 | 1514 | 5.90 | 11.26 |
| 244 | LC4 | jA | already | 576.52076 | 0.029405805 252622500 | 471 | 2194 | 4.48 | 13.70 |
| 245 | LC4 | butikA | shop | 581.021698 | 0.046716101 398942600 | 600 | 1122 | 5.58 | 9.26 |
| 246 | LC4 | ngkA | no | 590.979719 | 0.069873294 08173080 | 675 | 1447 | 6.19 | 10.96 |
| 247 | LC4 | kAzah | married | 591.153138 | 0.138314960 03501800 | 1038 | 1294 | 8.75 | 10.21 |
| 248 | LC4 | kazAh | married | 591.317253 | 0.121115172 2585560 | 910 | 1369 | 7.92 | 10.59 |
| 249 | LC4 | tA | is /going to | 592.368523 | 0.046782268 42395360 | 621 | 2099 | 5.76 | 13.41 |
| 250 | LC4 | fikAh | stay | 592.619854 | 0.061600194 19746730 | 562 | 1313 | 5.26 | 10.30 |
| 251 | LC4 | tokAh | knock/ play | 595.395064 | 0.066060488 66001400 | 594 | 1192 | 5.53 | 9.65 |
| 252 | LC4 | pAda | for | 595.951591 | 0.054877209 485539400 | 656 | 1446 | 6.04 | 10.95 |
| 253 | LC4 | tA | is /going to | 597.380992 | 0.043615117 67592670 | 456 | 1611 | 4.35 | 11.68 |
| 254 | LC4 | fikAh | stay | 597.680087 | 0.050795166 0974868 | 462 | 1328 | 4.40 | 10.38 |
| 255 | LC4 | ngkA | no | 614.333434 | 0.081958248 71995680 | 744 | 1381 | 6.72 | 10.65 |
| 256 | LC4 | gostAh | like | 620.146644 | 0.024820023 283837100 | 602 | 1958 | 5.60 | 12.97 |
| 257 | LC4 | gostAh | like | 633.271963 | 0.042412366 80275050 | 754 | 1685 | 6.80 | 11.98 |
| 258 | LC4 | fAsel | ? | 642.760240 | 0.167115124 78400400 | 925 | 1514 | 8.02 | 11.26 |
| 259 | LC4 | achAh | think | 643.367425 | 0.224677001 09848500 | 1028 | 1686 | 8.69 | 11.98 |
| 260 | LC4 | achAh | think | 654.179537 | 0.027581929 086636600 | 524 | 1559 | 4.94 | 11.46 |
| 261 | LC4 | fAzeh | do | 699.814792 | 0.102498476 3860180 | 580 | 1761 | 5.42 | 12.27 |

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|---|---|---|---|---|---|---|---|---|---|
| 262 | LC4 | fAzeh | do | 702.170238 | 0.11484950394049100 | 682 | 1700 | 6.25 | 12.04 |
| 263 | LC4 | gostAh | like | 735.491964 | 0.03865512471872900 | 666 | 1215 | 6.12 | 9.78 |
| 264 | LC4 | pAdeh | for | 740.247581 | 0.07694055864169510 | 728 | 1481 | 6.60 | 11.12 |
| 265 | LC4 | gostAh | like | 744.824446 | 0.10190391466642300 | 895 | 1717 | 7.81 | 12.10 |
| 266 | LC4 | jA | already | 748.659516 | 0.06848539987208820 | 580 | 2241 | 5.42 | 13.83 |
| 267 | LC4 | ngkA | no | 758.494915 | 0.05771237370640850 | 555 | 1105 | 5.21 | 9.16 |
| 268 | LC4 | ngkA | no | 763.695423 | 0.08056987338295580 | 685 | 1446 | 6.27 | 10.95 |
| 269 | LC4 | botAh | put | 767.641904 | 0.08512515477866 | 970 | 1660 | 8.32 | 11.88 |
| 270 | LC4 | sAbola | onion | 768.311077 | 0.10379141360 65870 | 899 | 1297 | 7.84 | 10.22 |
| 271 | LC4 | sAfrang | saffron | 771.548377 | 0.10053595487056600 | 902 | 1467 | 7.87 | 11.05 |
| 272 | LC4 | kAbah | then after | 778.603020 | 0.02807102870019660 | 608 | 1161 | 5.65 | 9.48 |
| 273 | LC4 | kabAh | then after | 778.863250 | 0.37366272077646280 | 697 | 1765 | 6.36 | 12.29 |
| 274 | LC4 | pApiah | speak | 813.316300 | 0.06328284474102470 | 808 | 1573 | 7.20 | 11.52 |
| 275 | LC4 | sA | theirs | 819.884959 | 0.03326219002951 8000 | 653 | 1411 | 6.01 | 10.79 |
| 276 | LC4 | kAza | home | 820.014482 | 0.06027750132693 6500 | 765 | 1275 | 6.88 | 10.11 |
| 277 | LC4 | kazA | home | 820.141202 | 0.03698846672330090 | 591 | 1504 | 5.51 | 11.22 |
| 278 | LC4 | portA | door | 820.625604 | 0.08503967128888230 | 810 | 1855 | 7.21 | 12.61 |
| 279 | LC4 | pApiah | speak | 823.098395 | 0.07744890045705690 | 824 | 1192 | 7.32 | 9.66 |
| 280 | LC4 | jA | already | 828.371759 | 0.03234715411713300 | 471 | 1737 | 4.48 | 12.18 |
| 281 | LC4 | pApiah | speak | 828.515349 | 0.05285998355714130 | 785 | 1195 | 7.03 | 9.67 |
| 282 | LC4 | fikAh | stay | 839.377311 | 0.05952246117396950 | 653 | 1487 | 6.02 | 11.14 |
| 283 | LC4 | pApiah | speak | 840.490034 | 0.05796433325388588 | 756 | 1238 | 6.82 | 9.91 |
| 284 | LC4 | fikAh | stay | 842.135438 | 0.05820720399538000 | 643 | 1496 | 5.93 | 11.18 |
| 285 | LC4 | chAdu | smart | 843.549196 | 0.11600101601038700 | 972 | 1487 | 8.33 | 11.14 |
| 286 | LC4 | pApiah | speak | 844.379902 | 0.04930435035316800 | 873 | 1205 | 7.66 | 9.73 |
| 287 | LC4 | pApiah | speak | 845.901651 | 0.05365404385247900 | 698 | 1175 | 6.37 | 9.56 |
| 288 | LC4 | sA | theirs | 857.382458 | 0.06603946896223080 | 688 | 1706 | 6.29 | 12.06 |
| 289 | LC4 | pApiah | speak | 862.422578 | 0.07252102177346840 | 880 | 1671 | 7.71 | 11.92 |
| 290 | LC4 | pApiah | speak | 866.440453 | 0.06329579686496340 | 886 | 1480 | 7.75 | 11.11 |
| 291 | LC4 | sA | theirs | 867.573803 | 0.02941752265564900 | 602 | 1524 | 5.60 | 11.31 |
| 292 | LC4 | kAza | home | 867.731529 | 0.15064989209350070 | 923 | 1539 | 8.01 | 11.37 |
| 293 | LC4 | pApiah | speak | 869.985283 | 0.06005199713013 1000 | 820 | 1418 | 7.28 | 10.82 |
| 294 | LC4 | pApiah | speak | 879.341320 | 0.04591614912737900 | 805 | 1441 | 7.18 | 10.93 |

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|---|---|---|---|---|---|---|---|---|---|
| 295 | LC4 | pApiah | speak | 889.832492 | 0.072752704 25475360 | 849 | 1479 | 7.50 | 11.10 |
| 296 | LC4 | tA | is /going to | 894.516519 | 0.031599211 35124930 | 730 | 1742 | 6.61 | 12.20 |
| 297 | LC4 | ngkA | no | 900.152210 | 0.073458941 27604420 | 665 | 1544 | 6.11 | 11.39 |
| 298 | LC4 | kAbah | then after | 901.772515 | 0.051661072 76136240 | 764 | 1836 | 6.87 | 12.54 |
| 299 | LC4 | kabAh | then after | 902.024916 | 0.340963080 2253790 | 908 | 1746 | 7.90 | 12.22 |
| 300 | LC4 | tA | is /going to | 904.734669 | 0.026090463 4178587 | 647 | 1404 | 5.97 | 10.76 |
| 301 | LC4 | ngkA | no | 910.141037 | 0.056186423 88515130 | 798 | 1703 | 7.13 | 12.05 |
| 302 | LC4 | chAdu | smart | 910.659826 | 0.171275429 84621900 | 1020 | 1795 | 8.64 | 12.40 |
| 303 | LC4 | sA | theirs | 911.542104 | 0.018321450 053576900 | 521 | 1873 | 4.92 | 12.68 |
| 304 | LC4 | chAdu | smart | 912.490432 | 0.099280798 13460040 | 872 | 1511 | 7.66 | 11.25 |
| 305 | LC4 | pApiah | speak | 912.771733 | 0.020233197 03960170 | 671 | 1259 | 6.16 | 10.02 |
| 306 | LC4 | sA | theirs | 914.768102 | 0.038452774 653933400 | 592 | 1886 | 5.52 | 12.72 |
| 307 | LC4 | sA | theirs | 917.496742 | 0.031810886 53752790 | 652 | 1234 | 6.01 | 9.89 |
| 308 | LC4 | pApiah | speak | 920.150782 | 0.067072816 9004633 | 816 | 1348 | 7.26 | 10.48 |
| 309 | LC4 | pApiah | speak | 921.750105 | 0.058473437 12468960 | 896 | 1425 | 7.82 | 10.85 |
| 310 | LC4 | pApiah | speak | 923.690746 | 0.043857005 6470553 | 645 | 1112 | 5.95 | 9.20 |
| 311 | LC4 | pApiah | speak | 925.486418 | 0.060226355 37294720 | 658 | 1655 | 6.06 | 11.86 |
| 312 | LC4 | kAbah | then after | 927.126163 | 0.037756855 987140600 | 614 | 1879 | 5.70 | 12.70 |
| 313 | LC4 | sA | theirs | 930.366511 | 0.048515808 750494200 | 735 | 1902 | 6.66 | 12.78 |
| 314 | LC4 | pApiah | speak | 938.878085 | 0.055896959 435131100 | 778 | 1169 | 6.98 | 9.53 |
| 315 | LC5 | sAtenta | seventy | 42.815793 | 0.072790950 88267700 | 783 | 1678 | 7.02 | 11.95 |
| 316 | LC5 | pAdri | priest | 59.328463 | 0.111776856 19711000 | 819 | 1542 | 7.28 | 11.39 |
| 317 | LC5 | kAda | each | 61.863169 | 0.086225347 1878418 | 696 | 1674 | 6.36 | 11.93 |
| 318 | LC5 | fAzeh | do | 66.263906 | 0.138601157 79260700 | 583 | 1609 | 5.44 | 11.67 |
| 319 | LC5 | fAzeh | do | 68.310054 | 0.114792221 87216500 | 748 | 1565 | 6.75 | 11.48 |
| 320 | LC5 | fAzeh | do | 69.476007 | 0.086694937 96523400 | 698 | 1589 | 6.37 | 11.58 |
| 321 | LC5 | jA | already | 69.907174 | 0.054670390 08857450 | 505 | 1734 | 4.78 | 12.17 |
| 322 | LC5 | kAbah | then after | 70.035735 | 0.076880236 06205260 | 631 | 1287 | 5.84 | 10.17 |
| 323 | LC5 | kabAh | then after | 70.164943 | 0.070021889 98119150 | 599 | 1289 | 5.58 | 10.18 |
| 324 | LC5 | judAh | help | 75.029319 | 0.108686365 2391090 | 634 | 1533 | 5.86 | 11.35 |
| 325 | LC5 | kAbah | then after | 79.058314 | 0.055980289 308152500 | 599 | 1286 | 5.58 | 10.16 |
| 326 | LC5 | kabAh | then after | 79.158824 | 0.050891172 09831780 | 542 | 1179 | 5.10 | 9.58 |
| 327 | LC5 | pApiah | speak | 92.247036 | 0.050904757 40804830 | 741 | 1420 | 6.70 | 10.83 |

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|---|---|---|---|---|---|---|---|---|---|
| 328 | LC5 | idAdi | age | 97.814235 | 0.189995373 23215100 | 790 | 1723 | 7.06 | 12.13 |
| 329 | LC5 | jA | already | 108.532729 | 0.040899589 36734210 | 517 | 1955 | 4.89 | 12.96 |
| 330 | LC5 | kAbah | then after | 108.683282 | 0.071064787 59033050 | 659 | 1328 | 6.07 | 10.38 |
| 331 | LC5 | fikAh | stay | 111.216605 | 0.068634795 36124830 | 600 | 1474 | 5.59 | 11.08 |
| 332 | LC5 | jA | already | 114.293222 | 0.047452510 597779000 | 560 | 1702 | 5.25 | 12.05 |
| 333 | LC5 | kAzah | marry | 114.482493 | 0.161769922 49241100 | 774 | 1623 | 6.95 | 11.73 |
| 334 | LC5 | kazAh | marry | 114.672303 | 0.103532750 39514600 | 804 | 1125 | 7.17 | 9.28 |
| 335 | LC5 | jA | already | 118.116378 | 0.068384784 84287690 | 445 | 1833 | 4.25 | 12.54 |
| 336 | LC5 | kAzah | marry | 118.319445 | 0.137414386 32102600 | 717 | 1708 | 6.52 | 12.07 |
| 337 | LC5 | kazAh | marry | 118.496058 | 0.190266073 3675670 | 692 | 1625 | 6.32 | 11.74 |
| 338 | LC5 | sA | their | 119.629881 | 0.043029149 75093590 | 560 | 1860 | 5.25 | 12.63 |
| 339 | LC5 | sA | their | 120.280526 | 0.058750953 22844000 | 586 | 1357 | 5.47 | 10.53 |
| 340 | LC5 | jA | already | 123.099404 | 0.038561824 647786100 | 501 | 2136 | 4.74 | 13.53 |
| 341 | LC5 | kAzah | marry | 123.243422 | 0.071461404 10186770 | 665 | 1169 | 6.11 | 9.53 |
| 342 | LC5 | jA | already | 128.480399 | 0.050324934 96011630 | 464 | 1797 | 4.42 | 12.40 |
| 343 | LC5 | kAzah | marry | 128.632467 | 0.101743890 24541600 | 758 | 1593 | 6.83 | 11.61 |
| 344 | LC5 | kazAh | marry | 128.749528 | 0.088615646 34281650 | 618 | 1824 | 5.73 | 12.50 |
| 345 | LC5 | jA | already | 132.00436 | 0.089571509 48774030 | 582 | 1796 | 5.43 | 12.40 |
| 346 | LC5 | jA | already | 135.982886 | 0.033806546 603500500 | 509 | 2026 | 4.82 | 13.19 |
| 347 | LC5 | kAbah | then after | 136.121634 | 0.073247517 64096500 | 759 | 1365 | 6.84 | 10.56 |
| 348 | LC5 | kabAh | then after | 136.261086 | 0.044371092 41709440 | 559 | 1195 | 5.24 | 9.67 |
| 349 | LC5 | achAh | think | 138.202278 | 0.071894850 62127690 | 577 | 1615 | 5.39 | 11.70 |
| 350 | LC5 | jA | already | 151.079283 | 0.029820064 152488600 | 504 | 1695 | 4.77 | 12.02 |
| 351 | LC5 | kAbah | then after | 151.216036 | 0.057776374 29542890 | 741 | 1371 | 6.70 | 10.60 |
| 352 | LC5 | kabAh | then after | 151.343237 | 0.036343203 185850800 | 566 | 1224 | 5.30 | 9.83 |
| 353 | LC5 | achAh | think | 154.789155 | 0.054625607 975452800 | 649 | 1670 | 5.99 | 11.92 |
| 354 | LC5 | kAbah | then after | 157.405584 | 0.063615976 47008920 | 681 | 1346 | 6.24 | 10.47 |
| 355 | LC5 | kabAh | then after | 157.667277 | 0.157594123 52815600 | 622 | 1350 | 5.76 | 10.49 |
| 356 | LC5 | achAh | think | 160.851869 | 0.082817563 62242730 | 578 | 1453 | 5.40 | 10.98 |
| 357 | LC5 | jA | already | 178.510595 | 0.028954465 19573850 | 523 | 1679 | 4.94 | 11.96 |
| 358 | LC5 | kAbah | then after | 178.650197 | 0.072386162 9893463 | 657 | 1299 | 6.04 | 10.23 |
| 359 | LC5 | jA | already | 178.510595 | 0.028954465 19573850 | 523 | 1679 | 4.94 | 11.96 |
| 360 | LC5 | kAbah | then after | 178.650197 | 0.072386162 9893463 | 657 | 1299 | 6.04 | 10.23 |

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|---|---|---|---|---|---|---|---|---|---|
| 361 | LC5 | kAza | home | 195.233347 | 0.209040268 60341700 | 894 | 1516 | 7.81 | 11.27 |
| 362 | LC5 | dA | give | 201.435529 | 0.066852084 16166690 | 583 | 1535 | 5.44 | 11.36 |
| 363 | LC5 | atAdi | afternoon | 205.229957 | 0.118417573 17023400 | 728 | 1628 | 6.60 | 11.75 |
| 364 | LC5 | kAzə | home | 206.023519 | 0.158025948 1939380 | 802 | 1599 | 7.15 | 11.63 |
| 365 | LC5 | dAh | give | 206.768751 | 0.047759987 80115740 | 636 | 1537 | 5.88 | 11.36 |
| 366 | LC5 | idAdi | age | 213.55896 | 0.165238494 0923640 | 793 | 1622 | 7.09 | 11.72 |
| 367 | LC5 | jA* | already | 216.697519 | 0.050135 | 533 | 1810 | 5.02 | 12.45 |
| 368 | LC5 | jA | already | 242.827914 | 0.025500187 259979200 | 468 | 1953 | 4.45 | 12.95 |
| 369 | LC5 | tA | was / going on | 254.77936 | 0.096122551 77000860 | 605 | 1266 | 5.63 | 10.06 |
| 370 | LC5 | jA | already | 258.737422 | 0.041082898 07362550 | 475 | 1597 | 4.52 | 11.62 |
| 371 | LC5 | jA | already | 268.099702 | 0.054952928 20330630 | 595 | 1446 | 5.54 | 10.95 |
| 372 | LC5 | jA | already | 269.235438 | 0.050313536 974840600 | 541 | 1618 | 5.09 | 11.71 |
| 373 | LC5 | kAbah | then after | 285.087634 | 0.064726614 12317390 | 722 | 1288 | 6.56 | 10.17 |
| 374 | LC5 | kabAh | then after | 285.218382 | 0.044014097 603735500 | 530 | 1229 | 5.00 | 9.86 |
| 375 | LC5 | dAh | give | 290.026215 | 0.075010318 07834120 | 830 | 1698 | 7.36 | 12.03 |
| 376 | LC5 | jA | already | 306.662454 | 0.040333607 555624000 | 525 | 2082 | 4.95 | 13.36 |
| 377 | LC5 | kAzah | marry | 306.793538 | 0.084028349 07434450 | 770 | 1652 | 6.92 | 11.85 |
| 378 | LC5 | kazAh | marry | 306.959914 | 0.062180978 31498430 | 674 | 1422 | 6.19 | 10.84 |
| 379 | LC5 | jA | already | 309.308644 | 0.045855711 208901100 | 514 | 1787 | 4.85 | 12.37 |
| 380 | LC5 | jA | already | 371.648508 | 0.045451615 677791300 | 552 | 1267 | 5.18 | 10.07 |
| 381 | LC5 | pAda | for | 372.615234 | 0.056055714 526792100 | 654 | 1746 | 6.02 | 12.22 |
| 382 | LC5 | jA | already | 373.935236 | 0.045198230 32990190 | 475 | 1505 | 4.52 | 11.22 |
| 383 | LC5 | jA | already | 375.73589 | 0.045350258 92948850 | 563 | 1763 | 5.27 | 12.28 |
| 384 | LC5 | fikAh | stay | 376.062412 | 0.057443661 31062860 | 724 | 1405 | 6.57 | 10.76 |
| 385 | LC5 | jA | already | 388.601035 | 0.044910350 39751520 | 548 | 1595 | 5.15 | 11.61 |
| 386 | LC5 | kAbah | then after | 392.969843 | 0.037444639 52551770 | 588 | 1279 | 5.49 | 10.13 |
| 387 | LC5 | kabAh | then after | 393.214218 | 0.246346312 6678110 | 667 | 1584 | 6.12 | 11.56 |
| 388 | LC5 | jA | already | 407.663759 | 0.048535763 0540193 | 523 | 1807 | 4.93 | 12.44 |
| 389 | LC5 | kAbah | then after | 407.823709 | 0.061595601 26860700 | 703 | 1356 | 6.41 | 10.52 |
| 390 | LC5 | kabAh | then after | 407.944935 | 0.055042877 72942010 | 570 | 1316 | 5.33 | 10.32 |
| 391 | LC5 | jA | already | 409.985916 | 0.034861810 83894730 | 494 | 1845 | 4.69 | 12.58 |
| 392 | LC5 | kAzah | marry | 410.168069 | 0.134217971 73003800 | 854 | 1586 | 7.53 | 11.57 |
| 393 | LC5 | kazAh | marry | 410.392056 | 0.093255343 9943149 | 756 | 1666 | 6.82 | 11.90 |

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|---|---|---|---|---|---|---|---|---|---|
| 394 | LC5 | sAbeh | know | 429.090305 | 0.084873914 54980300 | 760 | 1432 | 6.85 | 10.89 |
| 395 | LC5 | jA | already | 436.482522 | 0.041605063 699535100 | 552 | 1994 | 5.19 | 13.08 |
| 396 | LC5 | kAbah | then after | 436.630014 | 0.064363477 54697640 | 736 | 1329 | 6.66 | 10.39 |
| 397 | LC5 | kabAh | then after | 436.759217 | 0.035280721 025799300 | 598 | 1153 | 5.57 | 9.44 |
| 398 | LC5 | sAbeh | know | 440.638525 | 0.041648786 79773660 | 550 | 1327 | 5.17 | 10.38 |
| 399 | LC5 | ngkA | no | 441.867170 | 0.028480721 11999040 | 489 | 1452 | 4.64 | 10.98 |
| 400 | LC5 | sAbeh | know | 442.008556 | 0.061030116 68574250 | 714 | 1472 | 6.49 | 11.07 |
| 401 | LC5 | kAbah | then after | 462.470456 | 0.064457004 75222790 | 813 | 1304 | 7.23 | 10.26 |
| 402 | LC5 | kabAh | then after | 462.618707 | 0.079926685 89275810 | 807 | 1298 | 7.19 | 10.23 |
| 403 | LC5 | kAzah | marry | 463.068617 | 0.134070569 88461400 | 874 | 1559 | 7.67 | 11.46 |
| 404 | LC5 | kazAh | marry | 463.327734 | 0.165009932 1656170 | 834 | 1418 | 7.39 | 10.82 |
| 405 | LC5 | jA | already | 464.027921 | 0.055049842 299467900 | 589 | 1531 | 5.49 | 11.34 |
| 406 | LC5 | fikAh | stay | 465.032452 | 0.096588206 75150540 | 721 | 1657 | 6.55 | 11.87 |
| 407 | LC5 | fAzeh | do | 480.895860 | 0.111613809 56343700 | 780 | 1593 | 6.99 | 11.60 |
| 408 | LC5 | jA | already | 484.977866 | 0.038567006 9717321 | 578 | 2047 | 5.40 | 13.25 |
| 409 | LC5 | kAbah | then after | 485.106423 | 0.054636593 20997750 | 746 | 1280 | 6.74 | 10.13 |
| 410 | LC5 | kabAh | then after | 485.226141 | 0.034549610 41217080 | 616 | 1203 | 5.72 | 9.72 |
| 411 | LC5 | fikAh | stay | 487.0939 | 0.246710886 94538000 | 815 | 1468 | 7.25 | 11.05 |
| 412 | LC5 | pegAh | catch | 492.616977 | 0.091171114 38865780 | 624 | 1449 | 5.78 | 10.97 |
| 413 | LC5 | kAzə | home | 494.591491 | 0.248719759 8169930 | 855 | 1520 | 7.54 | 11.29 |
| 414 | LC5 | pegAh | catch | 501.462294 | 0.064592473 67195080 | 759 | 1596 | 6.84 | 11.62 |
| 415 | LC5 | jA | already | 506.487728 | 0.043843407 2285645 | 562 | 1817 | 5.27 | 12.48 |
| 416 | LC5 | kAbah | then after | 506.633443 | 0.051580479 09242210 | 757 | 1444 | 6.82 | 10.94 |
| 417 | LC5 | kabAh | then after | 506.74563 | 0.043843407 2285645 | 539 | 1262 | 5.07 | 10.04 |
| 418 | LC5 | pApiah | speak | 543.407123 | 0.048161683 82797060 | 697 | 1380 | 6.37 | 10.64 |
| 419 | LC5 | mandAh | send | 547.760998 | 0.043400284 64264380 | 614 | 1755 | 5.70 | 12.25 |
| 420 | LC5 | fAzeh | do | 550.29085 | 0.076137240 06102980 | 722 | 1695 | 6.56 | 12.02 |
| 421 | LC5 | jA | already | 590.277245 | 0.055600587 302819800 | 538 | 1825 | 5.06 | 12.51 |
| 422 | LC5 | kAzah | marry | 590.449102 | 0.149110665 9483420 | 864 | 1584 | 7.60 | 11.57 |
| 423 | LC5 | kazAh | marry | 590.810506 | 0.260311840 5539820 | 873 | 1587 | 7.66 | 11.58 |
| 424 | LC5 | jA | already | 592.069101 | 0.252729942 2853280 | 641 | 1397 | 5.92 | 10.72 |
| 425 | LC5 | tokAh | knock /play | 594.327307 | 0.059906692 63815110 | 680 | 1444 | 6.23 | 10.94 |
| 426 | LC5 | rondAdi | scolding | 594.665260 | 0.129534773 87043200 | 829 | 1603 | 7.35 | 11.64 |

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|---|---|---|---|---|---|---|---|---|---|
| 427 | LC5 | fAzeh | do | 634.949522 | 0.13986383302574300 | 737 | 1788 | 6.67 | 12.37 |
| 428 | LC5 | kAzah | marry | 637.908499 | 0.07706305299495850 | 811 | 1552 | 7.22 | 11.43 |
| 429 | LC5 | kazAh | marry | 638.080973 | 0.08366845753744200 | 666 | 1331 | 6.12 | 10.40 |
| 430 | LC5 | fAzeh | do | 638.551828 | 0.09344658503823670 | 774 | 1618 | 6.95 | 11.71 |
| 431 | LC5 | ngkA | no | 639.821296 | 0.02839590512076030 | 551 | 1623 | 5.18 | 11.73 |
| 432 | LC5 | sAbeh | know | 639.937064 | 0.08664391562501810 | 740 | 1368 | 6.70 | 10.58 |
| 433 | LC5 | kAzah | marry | 654.698099 | 0.08869755344448311 | 907 | 1410 | 7.90 | 10.78 |
| 434 | LC5 | kazAh | marry | 654.894735 | 0.08025016740248250 | 816 | 1470 | 7.26 | 11.06 |
| 435 | LC5 | tokAh | knock /play | 669.678476 | 0.04925784772569840 | 699 | 1231 | 6.38 | 9.87 |
| 436 | LC5 | fAzeh | do | 669.853426 | 0.09426932926817240 | 735 | 1530 | 6.66 | 11.33 |
| 437 | LC5 | fikAh | stay | 722.984183 | 0.05614432564095750 | 769 | 1636 | 6.91 | 11.78 |
| 438 | LC5 | kAzah | marry | 727.797132 | 0.12178766658382800 | 815 | 1419 | 7.25 | 10.83 |
| 439 | LC5 | kazAh | marry | 727.978877 | 0.06089383329197060 | 763 | 1305 | 6.86 | 10.26 |
| 440 | LC5 | kAzah | marry | 728.173737 | 0.13771374600602850 | 855 | 1444 | 7.54 | 10.94 |
| 441 | LC5 | fAzeh | do | 735.075067 | 0.05321207182566920 | 742 | 1686 | 6.71 | 11.98 |
| 442 | LC5 | chAdu | smart | 752.183199 | 0.13287121213602400 | 955 | 1354 | 8.22 | 10.51 |
| 443 | LC5 | kAbah | then after | 788.558873 | 0.06570317942771450 | 865 | 1456 | 7.61 | 11.00 |
| 444 | LC5 | kabAh | then after | 788.698849 | 0.04284989976267308 | 774 | 1442 | 6.95 | 10.93 |
| 445 | LC5 | fAzeh | do | 789.299367 | 0.08465846964327280 | 758 | 1562 | 6.83 | 11.47 |
| 446 | LC5 | kAbah | then after | 791.699260 | 0.00598423328949593 0 | 721 | 1404 | 6.55 | 10.75 |
| 447 | LC5 | kabAh | then after | 791.725975 | 0.01966248080805140 | 659 | 1323 | 6.06 | 10.35 |
| 448 | LC5 | kAza | home | 793.697358 | 0.08631152398641010 | 856 | 1567 | 7.54 | 11.49 |
| 449 | LC5 | kAza | home | 794.777007 | 0.11363767674045510 | 752 | 1525 | 6.78 | 11.31 |
| 450 | LC5 | fAzeh | do | 798.892212 | 0.12556925586352500 | 724 | 1654 | 6.57 | 11.86 |
| 451 | LC5 | lantAh | carry | 804.218451 | 0.06955917787115600 | 721 | 1577 | 6.55 | 11.54 |
| 452 | LC5 | lantAh | carry | 804.560896 | 0.07312631519789650 | 870 | 1600 | 7.64 | 11.63 |
| 453 | LC5 | jA | already | 812.017101 | 0.03344235788108560 | 512 | 2078 | 4.84 | 13.35 |
| 454 | LC5 | kAbah | then after | 812.142509 | 0.05685200839798200 | 734 | 1367 | 6.65 | 10.58 |
| 455 | LC5 | kabAh | then after | 812.269590 | 0.03678659356692624 | 561 | 1219 | 5.26 | 9.80 |
| 456 | LC5 | kAza | home | 816.277605 | 0.09806742465673320 | 826 | 1473 | 7.33 | 11.08 |
| 457 | LC5 | kAza | home | 823.640910 | 0.13429574301903800 | 794 | 1450 | 7.10 | 10.97 |
| 458 | LC5 | kAbah | then after | 826.985111 | 0.06104814286243250 | 663 | 1212 | 6.09 | 9.77 |
| 459 | LC5 | kabAh | then after | 827.086396 | 0.05133593831612870 0 | 560 | 1053 | 5.25 | 8.85 |

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|---|---|---|---|---|---|---|---|---|---|
| 460 | LC5 | fikAh | stay | 850.774022 | 0.076213573 05481520 | 683 | 1709 | 6.26 | 12.07 |
| 461 | LC5 | kAza | home | 861.786383 | 0.058600211 392558800 | 801 | 1589 | 7.15 | 11.59 |
| 462 | LC5 | tokAh | knock /play | 865.682930 | 0.026480734 342953800 | 612 | 1377 | 5.68 | 10.62 |
| 463 | LC5 | kAza | home | 866.095532 | 0.113678040 48347800 | 796 | 1605 | 7.11 | 11.65 |
| 464 | LC5 | santAh | sit / rest | 870.615107 | 0.175255201 54504200 | 829 | 1433 | 7.35 | 10.89 |
| 465 | LC5 | fAzeh | do | 872.785117 | 0.061197574 410812200 | 677 | 1582 | 6.21 | 11.56 |
| 466 | LC5 | andAh | walk | 893.350159 | 0.258841847 14686900 | 785 | 1459 | 7.03 | 11.01 |
| 467 | LC5 | fAzeh | do | 926.669944 | 0.093461886 89289650 | 728 | 1566 | 6.61 | 11.49 |
| 468 | LC5 | fAzeh | do | 927.314935 | 0.095787539 09931950 | 657 | 1466 | 6.05 | 11.05 |
| 469 | LC5 | kAbah | then after | 959.977393 | 0.055651235 21205350 | 645 | 1493 | 5.95 | 11.17 |
| 470 | LC5 | botAh | put | 960.666519 | 0.062397790 084560300 | 647 | 1431 | 5.96 | 10.88 |
| 471 | LC5 | sAbola | onion | 979.959802 | 0.068700397 94534930 | 787 | 1416 | 7.04 | 10.81 |
| 472 | LC5 | botAh | put | 999.846213 | 0.121983967 21703400 | 893 | 1590 | 7.80 | 11.59 |
| 473 | LC5 | desAh | those | 1002.250992 | 0.044994408 8356915 | 621 | 1501 | 5.75 | 11.20 |
| 474 | LC5 | fAzeh | do | 1012.581766 | 0.055142055 52901790 | 584 | 1671 | 5.45 | 11.92 |
| 475 | LC5 | botAh | put | 1014.218453 | 0.106910780 5647040 | 898 | 1464 | 7.83 | 11.04 |
| 476 | LC5 | artApal | potatoes | 1014.419581 | 0.058473944 37660110 | 851 | 1367 | 7.50 | 10.57 |
| 477 | LC5 | artApal | potatoes | 1016.776310 | 0.071915098 25918270 | 836 | 1629 | 7.40 | 11.75 |
| 478 | LC5 | botAh | put | 1017.734611 | 0.180964450 38020200 | 807 | 1554 | 7.19 | 11.44 |
| 479 | LC5 | artApal | potatoes | 1025.051636 | 0.043861144 848961000 | 762 | 1605 | 6.86 | 11.65 |
| 480 | LC5 | artApal | potatoes | 1025.687416 | 0.068550816 14935440 | 805 | 1566 | 7.18 | 11.49 |
| 481 | LC5 | artApal | potatoes | 1028.561048 | 0.073813822 85598190 | 761 | 1416 | 6.85 | 10.81 |
| 482 | LC5 | kortAh | cut | 1032.162664 | 0.062141534 599504700 | 706 | 1379 | 6.43 | 10.63 |
| 483 | LC5 | kortAh | cut | 1034.775076 | 0.035486187 89113790 | 565 | 1276 | 5.29 | 10.11 |
| 484 | LC5 | kAbah | then after | 1043.717353 | 0.043567655 81042050 | 692 | 1330 | 6.32 | 10.39 |
| 485 | LC5 | artApal | potatoes | 1048.129604 | 0.080694775 78806070 | 885 | 1431 | 7.75 | 10.88 |
| 486 | LC5 | artApal | potatoes | 1050.818754 | 0.088203963 97936750 | 790 | 1560 | 7.07 | 11.46 |
| 487 | LC5 | lantAh | carry | 1052.647841 | 0.193958183 1261420 | 851 | 1550 | 7.51 | 11.42 |
| 488 | LC5 | kAbah | then after | 1053.530113 | 0.100739686 91654000 | 638 | 1334 | 5.89 | 10.41 |
| 489 | LC5 | kabAh | then after | 1053.708566 | 0.064761227 30327920 | 612 | 1228 | 5.68 | 9.86 |
| 490 | LC5 | botAh | put | 1061.374310 | 0.058664077 612775100 | 590 | 1331 | 5.50 | 10.40 |
| 491 | LC5 | botAh | put | 1069.701798 | 0.029363136 63076360 | 598 | 1596 | 5.57 | 11.62 |
| 492 | LC5 | artApal | potatoes | 1070.145606 | 0.059307926 82875110 | 878 | 1319 | 7.69 | 10.33 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 493 | LC5 | botAh | put | 1099.820863 | 0.123350193 88274300 | 689 | 1701 | 6.30 | 12.04 |
| 494 | LC5 | sAbola | onion | 1109.289745 | 0.086012737 50196010 | 828 | 1317 | 7.35 | 10.32 |
| | Ave | | | | 0.08752 | 721.96 | 1598.11 | 6.514 | 11.540 |
| | SD | | | | 0.06362 | 135.14 | 243.42 | 1.03 | 1.05 |

## APPENDIX C1 - CV and CCV Syllables /i/ Vowels produced by LC5

| CV syllables | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) |
|---|---|---|---|---|
| fIkah | 366 | 1685 | 3.540 | 11.977 |
| sIbrisu | 417 | 1588 | 4.005 | 11.583 |
| nakIh | 377 | 1546 | 3.639 | 11.402 |
| dIses | 373 | 1642 | 3.598 | 11.804 |
| fIkah | 381 | 2302 | 3.673 | 13.999 |
| sIbrisu | 493 | 1764 | 4.672 | 12.283 |
| fIkah | 403 | 2562 | 3.873 | 14.659 |
| fIkah | 402 | 2034 | 3.869 | 13.211 |
| fIkah | 502 | 2002 | 4.754 | 13.111 |
| nakIh | 593 | 2412 | 5.530 | 14.289 |
| fIkah | 399 | 1890 | 3.840 | 12.737 |
| kI | 570 | 2060 | 5.336 | 13.294 |
| fIkah | 531 | 1452 | 5.004 | 10.978 |
| sIbrisu | 392 | 1604 | 3.772 | 11.649 |
| butIka | 366 | 1564 | 3.532 | 11.479 |
| butIka | 416 | 1628 | 3.988 | 11.748 |
| ubIh | 525 | 1459 | 4.949 | 11.013 |
| fIkah | 510 | 1843 | 4.824 | 12.571 |
| sIbrisu | 501 | 1862 | 4.743 | 12.639 |
| butIka | 505 | 1287 | 4.784 | 10.168 |
| fIkah | 471 | 1537 | 4.486 | 11.363 |
| sIbrisu | 393 | 1557 | 3.783 | 11.449 |
| nakIh | 395 | 1637 | 3.804 | 11.785 |
| frizIh corrected | 491 | 1297 | 4.655 | 10.222 |
| kuzIdu | 420 | 2232 | 4.024 | 13.806 |
| frizIh corrected | 622 | 1991 | 5.761 | 13.074 |
| frizIh | 482 | 1773 | 4.575 | 12.315 |
| frizIh | 623 | 2164 | 5.772 | 13.610 |

| CCV Syllables | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) |
|---|---|---|---|---|
| skIseh | 558 | 1433 | 5.235 | 10.891 |

## APPENDIX C2 - CV and CVC Syllables /e/ Vowels produced by LC5

| CV | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) |
|---|---|---|---|---|
| sEti | 605.77 | 1557.63 | 5.632 | 11.453 |
| Pesi | 450.06 | 1597.71 | 4.297 | 11.623 |
| Pesi | 397.82 | 2078.28 | 3.827 | 13.351 |
| pEgah | 694.38 | 2030.26 | 6.343 | 13.201 |
| pEsi | 561.70 | 2055.36 | 5.265 | 13.280 |
| sEdu | 432.42 | 2029.03 | 4.139 | 13.197 |
| sEku | 704.43 | 1573.27 | 6.421 | 11.520 |
| azEti | 591.35 | 2729.14 | 5.513 | 15.041 |
| dEsah | 547.72 | 1467.51 | 5.147 | 11.052 |
| dEsah | 527.28 | 1906.49 | 4.972 | 12.793 |
| sEku corrected but still a outlier | 704.86 | 1145.05 | 6.424 | 9.391 |
| mbEs | 413.26 | 1968.12 | 3.967 | 13.000 |
| mbEs | 531.70 | 1984.17 | 5.010 | 13.053 |
| mbEs | 477.30 | 2320.48 | 4.538 | 14.049 |
| fazEh | 484.20 | 2266.06 | 4.599 | 13.900 |
| fazEh | 513.09 | 2397.81 | 4.850 | 14.252 |
| fazEh | 457.12 | 1919.14 | 4.360 | 12.836 |
| prendEh | 442.76 | 1651.46 | 4.232 | 11.844 |
| sabEh | 469.64 | 1915.89 | 4.470 | 12.825 |
| fazEh | 486.02 | 1694.93 | 4.614 | 12.017 |
| bebeh | 492.09 | 2345.53 | 4.668 | 14.116 |
| bebeh | 432.00 | 2047.71 | 4.136 | 13.256 |
| prendEh | 482.04 | 2377.37 | 4.580 | 14.199 |
| prendEh | 505.60 | 2117.79 | 4.785 | 13.472 |
| kuzEh | 508.62 | 1952.89 | 4.811 | 12.950 |
| fazEh | 466.67 | 2132.91 | 4.444 | 13.517 |
| akEh | 467.41 | 1778.17 | 4.451 | 12.335 |
| prendEh | 543.68 | 2470.30 | 5.112 | 14.436 |
| fazEh | 553.38 | 2366.61 | 5.195 | 14.171 |

| | | | | |
|---|---|---|---|---|
| sabEh | 439.99 | 1307.85 | 4.207 | 10.277 |
| akEh | 533.27 | 1730.66 | 5.023 | 12.156 |
| fazEh | 537.38 | 2116.60 | 5.059 | 13.468 |
| akEh | 468.35 | 1464.25 | 4.459 | 11.037 |
| ntEh | 465.48 | 2547.92 | 4.434 | 14.625 |
| prendEh | 436.45 | 1739.30 | 4.176 | 12.189 |
| prendEh | 574.11 | 1969.29 | 5.369 | 13.004 |
| fazEh | 508.49 | 1957.95 | 4.810 | 12.966 |
| kuzEh | 566.44 | 2393.94 | 5.305 | 14.242 |
| ntEh | 440.84 | 1583.53 | 4.215 | 11.563 |
| fazEh | 453.56 | 1824.18 | 4.328 | 12.504 |
| fazEh | 451.32 | 1053.96 | 4.308 | 8.849 |
| akEh | 504.83 | 627.30 | 4.778 | 5.808 |
| fazEh | 433.34 | 1904.28 | 4.148 | 12.785 |
| fubEh | 462.10 | 1689.64 | 4.404 | 11.996 |
| akEh | 565.86 | 1702.1 | 5.300 | 12.045 |

| CVC | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) |
|---|---|---|---|---|
| sEz | 444.96 | 2276.50 | 4.252 | 13.929 |
| sEz | 521.08 | 1262.50 | 4.919 | 10.041 |
| sEz | 592.12 | 2538.60 | 5.519 | 14.603 |
| sEz | 521.44 | 1575.03 | 4.922 | 11.527 |
| dEs | 503.28 | 1701.12 | 4.765 | 12.042 |
| dEs | 551.03 | 1305.81 | 5.175 | 10.267 |
| disEs | 471.25 | 2472.74 | 4.485 | 14.442 |
| disEs | 432.98 | 1474.01 | 4.144 | 11.082 |

## APPENDIX C3 - MPC /e/ before /t/, /s/ and /z/ Environment

| /et/ | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) |
|---|---|---|---|---|
| sEti | 671.90 | 2440.04 | 6.166 | 14.360 |
| sEti | 605.77 | 1557.63 | 5.632 | 11.453 |
| azEti | 591.35 | 2729.14 | 5.513 | 15.041 |

| /es/ | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) |
|---|---|---|---|---|
| fEstival | 630.61 | 2045.3885 | 5.835 | 13.249 |
| fEstival | 538.81 | 2243.1791 | 5.071 | 13.836 |
| pEsi | 423.26 | 2701.1041 | 4.057 | 14.979 |
| dEsa | 532.64 | 2260.2943 | 5.018 | 13.884 |
| sEsta | 599.43 | 2167.00 | 5.580 | 13.618 |
| sEstafera | 565.81 | 1970.82 | 5.299 | 13.009 |
| sEstafera | 588.29 | 2016.86 | 5.487 | 13.158 |
| pEsi (diphthong pEIsi) | 389.16 | 2803.36 | 3.748 | 15.201 |
| pEsi | 638.51 | 2329.86 | 5.899 | 14.074 |
| pEsi | 490.66 | 2700.81 | 4.655 | 14.978 |
| pEsi | 438.57 | 2752.85 | 4.194 | 15.093 |
| pEsi | 468.65 | 2715.18 | 4.462 | 15.010 |
| pEskədor | 639.61 | 2078.72 | 5.908 | 13.353 |
| pEsi | 562.35 | 2731.82 | 5.270 | 15.047 |
| pEsi | 570.02 | 2646.42 | 5.335 | 14.856 |
| pEsi | 481.43 | 2637.02 | 4.574 | 14.834 |
| pEsi | 540.84 | 2690.20 | 5.088 | 14.955 |
| Pesi | 450.06 | 1597.71 | 4.297 | 11.623 |
| Pesi | 397.82 | 2078.28 | 3.827 | 13.351 |
| pEsi | 561.70 | 2055.36 | 5.265 | 13.280 |
| dEsah | 547.72 | 1467.51 | 5.147 | 11.052 |
| dEsah | 527.28 | 1906.49 | 4.972 | 12.793 |
| mbEs | 441.10 | 2631.9887 | 4.217 | 14.823 |
| mbEs | 433.06 | 2476.4498 | 4.145 | 14.451 |
| mbEs | 447.39 | 2592.8387 | 4.273 | 14.732 |

| | | | | |
|---|---|---|---|---|
| bEs | 550.17 | 2085.5824 | 5.167 | 13.374 |
| dEs | 529.23 | 2271.37 | 4.989 | 13.915 |
| mbEs | 468.62 | 2529.80 | 4.462 | 14.582 |
| bEs | 402.72 | 2635.06 | 3.871 | 14.830 |
| dEs | 503.28 | 1701.12 | 4.765 | 12.042 |
| disEs | 471.25 | 2472.74 | 4.485 | 14.442 |
| dEs | 551.03 | 1305.81 | 5.175 | 10.267 |
| mbEs | 413.26 | 1968.12 | 3.967 | 13.000 |
| mbEs | 531.70 | 1984.17 | 5.010 | 13.053 |
| mbEs | 477.30 | 2320.48 | 4.538 | 14.049 |

| /ez/ | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) |
|---|---|---|---|---|
| sEz | 626.08 | 2431.43 | 5.798 | 14.338 |
| sEz | 444.96 | 2276.50 | 4.252 | 13.929 |
| sEz | 521.08 | 1262.50 | 4.919 | 10.041 |
| sEz | 592.12 | 2538.60 | 5.519 | 14.603 |
| sEz | 521.44 | 1575.03 | 4.922 | 11.527 |

## APPENDIX C4 - *seti* and *azeti* for /e/ Vowels

| /et/ | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) |
|---|---|---|---|---|
| sEti | 671.90 | 2440.04 | 6.166 | 14.360 |
| sEti | 605.77 | 1557.63 | 5.632 | 11.453 |
| azEti | 591.35 | 2729.14 | 5.513 | 15.041 |

## APPENDIX C5 - MPC /e/ based on Vowel Height of following Vowels

| high vowel height /i/ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| No | /e/ | Word | Meaning | Time | Duration | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) |
| 1 | LC1 | fEstival | festival | 183.77745 | 0.11386 | 631 | 2045 | 5.83 | 13.25 |
| 2 | LC1 | fEstival | festival | 186.19532 | 0.1018 | 539 | 2243 | 5.07 | 13.84 |
| 3 | LC1 | pEsi | fish | 378.26398 | 0.13047 | 423 | 2701 | 4.06 | 14.98 |
| 4 | LC4 | sEti | seven | 213.1264 | 0.1821717 | 672 | 2440 | 6.17 | 14.36 |
| 5 | LC4 | pEsi | fish | 567.5984 | 0.2364532 | 389 | 2803 | 3.75 | 15.20 |
| 6 | LC4 | pEsi | fish | 636.22208 | 0.1409947 | 639 | 2330 | 5.90 | 14.07 |
| 7 | LC4 | pEsi | fish | 638.02435 | 0.208251 | 491 | 2701 | 4.66 | 14.98 |
| 8 | LC4 | pEsi | fish | 640.98781 | 0.1749108 | 439 | 2753 | 4.19 | 15.09 |
| 9 | LC4 | pEsi | fish | 642.34245 | 0.1541173 | 469 | 2715 | 4.46 | 15.01 |
| 10 | LC4 | pEsi | fish | 667.11959 | 0.1967024 | 562 | 2732 | 5.27 | 15.05 |
| 11 | LC4 | pEsi | fish | 667.99192 | 0.1018314 | 570 | 2646 | 5.33 | 14.86 |
| 12 | LC4 | pEsi | fish | 699.0961 | 0.2232329 | 481 | 2637 | 4.57 | 14.83 |
| 13 | LC4 | pEsi | fish | 754.02855 | 0.2111797 | 541 | 2690 | 5.09 | 14.95 |
| 14 | LC5 | sEti | seven | 99.430361 | 0.13515 | 606 | 1558 | 5.63 | 11.45 |
| 15 | LC5 | pesi | fish | 489.09928 | 0.23894 | 450 | 1598 | 4.30 | 11.62 |
| 16 | LC5 | pesi | fish | 492.89686 | 0.23103 | 398 | 2078 | 3.83 | 13.35 |
| 17 | LC5 | pEsi | fish | 501.6367 | 0.04672 | 562 | 2055 | 5.26 | 13.28 |
| 18 | LC5 | azEti | oil | 1000.103 | 0.10876 | 591 | 2729 | 5.51 | 15.04 |
| high vowel /u/ | | | | | | | | | |
| 1 | LC1 | pEdru | peter | 204.39563 | 0.10537 | 466 | 2426 | 4.44 | 14.33 |
| 2 | LC1 | sEdu | early | 227.97469 | 0.14426 | 458 | 2592 | 4.37 | 14.73 |
| 3 | LC2 | pEdru | peter | 287.23973 | 0.08968 | 440 | 2309 | 4.21 | 14.02 |
| 4 | LC4 | sEdu | early | 533.01771 | 0.1571094 | 435 | 2583 | 4.16 | 14.71 |
| 5 | LC4 | sEdu | searly | 538.56322 | 0.1841759 | 396 | 2843 | 3.81 | 15.28 |
| 6 | LC4 | sEdu | early | 545.35497 | 0.1474052 | 462 | 2777 | 4.40 | 15.14 |
| 7 | LC4 | sEku | dry | 689.46093 | 0.1615928 | 549 | 2380 | 5.16 | 14.21 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 8 | LC5 | sEdu | early | 575.00297 | 0.08848 | 432 | 2029 | 4.14 | 13.20 |
| 9 | LC5 | sEku | dry | 982.35844 | 0.12519 | 704 | 1573 | 6.42 | 11.52 |
| 10 | LC5 | sEku | dry | 1117.9162 | 0.14739 | 705 | 1145 | 6.42 | 9.39 |
| low vowel height /a/ | | | | | | | | | |
| No | /e/ | Word | Meaning | Time | Duration | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) |
| 1 | LC1 | dEsa | give/ allow | 541.80673 | 0.10764 | 533 | 2260 | 5.02 | 13.88 |
| 2 | LC2 | sEsta | sixth | 169.86753 | 0.14386 | 599 | 2167 | 5.58 | 13.62 |
| 3 | LC2 | sEstafera | Friday | 171.63068 | 0.0959 | 566 | 1971 | 5.30 | 13.01 |
| 4 | LC2 | sEstafera | Friday | 184.06404 | 0.12948 | 588 | 2017 | 5.49 | 13.16 |
| 5 | LC3 | kEbrah | spoil | 446.8595 | 0.11371 | 807 | 2186 | 7.19 | 13.67 |
| 6 | LC5 | pEgah | catch | 501.36325 | 0.0609 | 694 | 2030 | 6.34 | 13.20 |
| 7 | LC5 | dEsah | these | 1002.1125 | 0.06731 | 548 | 1468 | 5.15 | 11.05 |
| 8 | LC5 | dEsah | these | 1003.9359 | 0.05144 | 527 | 1906 | 4.97 | 12.79 |

## APPENDIX C6 - CV and CVC Syllables /ə/ Vowels

| /ə/ CV syllable | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) |
|---|---|---|---|---|
| satentA(Schwa) | 545.627 | 2233.32 | 5.129 | 13.809 |
| satentA(Schwa) | 550.854 | 2099.87 | 5.173 | 13.417 |
| pəgah | 513.988 | 1805.69 | 4.858 | 12.437 |
| portUgis(Schwa) ?? | 440.932 | 2152.95 | 4.216 | 13.577 |
| yosA(Schwa) | 567.176 | 2063.17 | 5.311 | 13.304 |
| kazə | 656.546 | 2068.27 | 6.044 | 13.320 |
| jA(Schwa) | 414.809 | 2388.87 | 3.981 | 14.229 |
| yosə | 660.178 | 2034.61 | 6.073 | 13.215 |
| jA(Schwa) | 466.198 | 2430.14 | 4.440 | 14.335 |
| yosA(Schwa) | 517.668 | 1560.9 | 4.889 | 11.467 |
| jA (Schwa) | 450.914 | 1866.72 | 4.305 | 12.655 |
| batatə | 431.905 | 1457.78 | 4.135 | 11.007 |
| botəh | 462.092 | 1935.36 | 4.404 | 12.891 |
| trempə | 533.599 | 1327.86 | 5.026 | 10.379 |
| botƟh | 472.217 | 1785.51 | 4.493 | 12.362 |
| kabəh | 525.844 | 1373.63 | 4.960 | 10.607 |
| botək | 459.513 | 1869.76 | 4.381 | 12.666 |
| kazə | 652.286 | 1626.17 | 6.009 | 11.741 |
| fikəh | 668.783 | 1741.36 | 6.141 | 12.197 |
| batatə | 599.277 | 1914.88 | 5.578 | 12.822 |
| kabəh | 634.829 | 1677.66 | 5.869 | 11.949 |
| fikAh(Schwa) | 502.926 | 1142.83 | 4.762 | 9.378 |
| kabəh | 609.969 | 1855.18 | 5.666 | 12.614 |
| kə | 467.739 | 2405.19 | 4.454 | 14.271 |
| jA(Schwa) | 481.655 | 2077.01 | 4.576 | 13.347 |
| kabəh | 673.16 | 1664.97 | 6.176 | 11.898 |
| kazə | 643.691 | 1641.67 | 5.940 | 11.804 |
| padri sə chang | 545.474 | 2177.42 | 5.127 | 13.648 |
| kabəh | 566.045 | 1612.91 | 5.301 | 11.686 |

| | | | | |
|---|---|---|---|---|
| sə | 580.685 | 1703.58 | 5.424 | 12.051 |
| kazə | 472.262 | 1652.69 | 4.494 | 11.849 |
| tə | 531.079 | 2054.3 | 5.005 | 13.277 |
| kə | 511.791 | 2445.35 | 4.839 | 14.374 |
| akəh | 513.893 | 2381.48 | 4.857 | 14.210 |
| yosə | 436.708 | 1838.22 | 4.178 | 12.554 |
| kə | 624.618 | 1294.04 | 5.786 | 10.206 |
| kabAh (Schwa) | 552.922 | 1249.07 | 5.191 | 9.969 |
| kabəh | 521.873 | 1243.2 | 4.926 | 9.938 |
| kazə | 479.189 | 1617.58 | 4.555 | 11.706 |
| kazə | 497.928 | 1833.53 | 4.718 | 12.537 |
| kazə | 539.697 | 1554.45 | 5.078 | 11.439 |
| tokəh | 648.681 | 1001.35 | 5.981 | 8.519 |
| ngkə | 502.836 | 1567.87 | 4.761 | 11.497 |
| butikə | 507.339 | 1278.2 | 4.800 | 10.123 |
| tokəh | 710.955 | 1679.35 | 6.471 | 11.956 |
| bokəh | 782.555 | 1585.63 | 7.013 | 11.572 |
| mandəh | 629.716 | 1590.52 | 5.827 | 11.593 |
| labəh | 601.14 | 1261.17 | 5.594 | 10.034 |
| kabəh | 575.66 | 1602.64 | 5.382 | 11.644 |
| desəh | 504.133 | 1764.14 | 4.772 | 12.283 |
| botəh corrected | 652.091 | 1498.07 | 6.008 | 11.191 |
| kortəh corrected | 589.154 | 1382.52 | 5.494 | 10.650 |
| kabəh | 472.25 | 1074.91 | 4.494 | 8.977 |
| botəh | 543.02 | 1828.97 | 5.107 | 12.521 |
| kabAh | 542.234 | 1178.64 | 5.100 | 9.583 |
| kabAh (Schwa) | 517.077 | 1267.21 | 4.884 | 10.066 |
| fikAh (schwa) | 500.542 | 1493.93 | 4.741 | 11.172 |
| səsenta | 554.628 | 1699.92 | 5.205 | 12.037 |
| səsenta | 600.698 | 1698.77 | 5.590 | 12.032 |
| səsenta | 606.248 | 1851.18 | 5.636 | 12.600 |
| peskədor | 549.008 | 1819.65 | 5.157 | 12.487 |

| Schwa CVC | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) |
|---|---|---|---|---|
| festibəl | 619.8572 | 1864.455 | 5.747 | 12.647 |
| festibəl | 533.8323 | 1784.322 | 5.028 | 12.358 |

## APPENDIX C7 - CV and CVC Syllables /u/ Vowels

| /u/ CV Syllable | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) |
|---|---|---|---|---|
| singkU | 440 | 919 | 4.210 | 7.976 |
| tudU | 420 | 1229 | 4.032 | 9.859 |
| kU | 355 | 1138 | 3.434 | 9.348 |
| justU | 436 | 1345 | 4.176 | 10.463 |
| nubU | 410 | 1738 | 3.941 | 12.182 |
| tudU | 413 | 1972 | 3.962 | 13.014 |
| tudU | 439 | 1642 | 4.200 | 11.805 |
| tudU | 370 | 2431 | 3.572 | 14.337 |
| kU | 442 | 1622 | 4.228 | 11.723 |
| kU | 406 | 1268 | 3.906 | 10.070 |
| sabdU | 482 | 1663 | 4.576 | 11.891 |
| kU | 424 | 1671 | 4.066 | 11.922 |
| olotU | 489 | 1912 | 4.643 | 12.811 |
| olotU | 417 | 2040 | 3.999 | 13.232 |
| olotU | 457 | 1742 | 4.359 | 12.198 |
| olotU | 381 | 1755 | 3.674 | 12.250 |
| olotU | 523 | 1335 | 4.935 | 10.417 |
| olotU | 435 | 1241 | 4.165 | 9.924 |
| machU | 414 | 1426 | 3.977 | 10.861 |
| kU | 371 | 1574 | 3.578 | 11.524 |
| tudU | 423 | 1237 | 4.052 | 9.903 |
| retU | 481 | 1490 | 4.572 | 11.155 |
| tudU | 504 | 1288 | 4.774 | 10.173 |
| kazamintU | 438 | 1078 | 4.187 | 8.998 |
| sabdU | 415 | 1213 | 3.985 | 9.776 |
| nuibU | 439 | 1226 | 4.197 | 9.842 |
| sabdU | 353 | 1491 | 3.413 | 11.159 |
| kazamintU | 437 | 1188 | 4.180 | 9.633 |
| fikU | 380 | 1172 | 3.667 | 9.543 |

| | | | | |
|---|---|---|---|---|
| fritU | 417 | 1383 | 3.998 | 10.653 |
| singkU | 373 | 1337 | 3.600 | 10.424 |
| tudU | 418 | 1393 | 4.007 | 10.699 |
| olotU | 353 | 1639 | 3.411 | 11.793 |
| kU | 554 | 1007 | 5.198 | 8.557 |
| machU | 519 | 1681 | 4.900 | 11.961 |
| machU | 558 | 1561 | 5.237 | 11.468 |
| machU | 483 | 1532 | 4.585 | 11.342 |
| tudU | 473 | 1830 | 4.500 | 12.525 |
| tudU | 498 | 1692 | 4.719 | 12.004 |
| tudU | 572 | 1808 | 5.350 | 12.444 |
| tantU | 537 | 1182 | 5.058 | 9.599 |
| bredU | 384 | 1573 | 3.704 | 11.517 |
| olotU | 462 | 1647 | 4.400 | 11.825 |
| olotU | 577 | 1365 | 5.392 | 10.567 |
| olotU | 558 | 1882 | 5.230 | 12.708 |
| nitU | 426 | 2027 | 4.080 | 13.192 |
| tudU | 494 | 1269 | 4.686 | 10.077 |
| tudU | 493 | 895 | 4.678 | 7.812 |
| tudU | 473 | 2035 | 4.497 | 13.215 |
| tUdu | 413 | 1878 | 3.963 | 12.694 |
| tUdu | 390 | 2109 | 3.751 | 13.446 |
| tUdu | 423 | 1736 | 4.058 | 12.176 |
| tUdu | 373 | 1668 | 3.600 | 11.910 |
| kUkis | 394 | 1131 | 3.788 | 9.312 |
| jUdah | 410 | 1854 | 3.939 | 12.610 |
| kUkis | 629 | 1780 | 5.818 | 12.341 |
| kUkis | 478 | 1006 | 4.542 | 8.551 |
| jUstu | 421 | 2065 | 4.035 | 13.309 |
| tUdu | 424 | 1564 | 4.063 | 11.479 |
| tUdu | 443 | 1780 | 4.238 | 12.341 |
| tUdu | 432 | 1964 | 4.131 | 12.987 |

| | | | | |
|---|---|---|---|---|
| kUkus | 443 | 867 | 4.234 | 7.617 |
| kUkus | 374 | 1157 | 3.606 | 9.459 |
| portUgis | 405 | 2141 | 3.894 | 13.540 |
| kUkis | 386 | 1112 | 3.718 | 9.198 |
| tUdu | 411 | 1471 | 3.950 | 11.067 |
| tUdu | 479 | 1492 | 4.549 | 11.165 |
| tUdu | 388 | 1483 | 3.735 | 11.122 |
| kUzinyah | 462 | 1582 | 4.406 | 11.556 |
| tUdu | 569 | 1497 | 5.327 | 11.184 |
| tUdu | 459 | 1245 | 4.378 | 9.950 |
| tUdu | 471 | 1727 | 4.484 | 12.141 |
| tUdu | 515 | 1420 | 4.864 | 10.830 |
| tUdu | 601 | 1829 | 5.596 | 12.520 |
| tUdu | 532 | 1846 | 5.010 | 12.581 |
| tUdu | 443 | 1605 | 4.230 | 11.653 |
| sUdeh | 558 | 2091 | 5.237 | 13.392 |
| bUtika | 465 | 2028 | 4.430 | 13.194 |
| kUzinyah | 452 | 1936 | 4.312 | 12.893 |
| kUzinyah | 460 | 1766 | 4.387 | 12.290 |
| bUtika | 512 | 1257 | 4.837 | 10.013 |
| kUzinyah | 485 | 1233 | 4.608 | 9.885 |
| kUzinyah | 574 | 1373 | 5.368 | 10.603 |
| kUzinyah | 525 | 1607 | 4.955 | 11.663 |
| kUzinyah | 461 | 1715 | 4.391 | 12.097 |
| kUzinyah | 483 | 1732 | 4.591 | 12.161 |
| kUzeh | 483 | 1062 | 4.591 | 8.900 |
| kUzeh | 475 | 1800 | 4.520 | 12.417 |
| kUzeh | 483 | 1732 | 4.584 | 12.162 |
| kUzeh | 479 | 1638 | 4.551 | 11.790 |
| kUzeh | 450 | 1413 | 4.295 | 10.796 |
| jUdah | 420 | 1658 | 4.032 | 11.869 |
| kUzinyah | 432 | 1849 | 4.137 | 12.593 |

| | | | | |
|---|---|---|---|---|
| kUzinyah | 411 | 2146 | 3.949 | 13.555 |
| tUdu | 509 | 1562 | 4.814 | 11.471 |
| tUdu | 388 | 1453 | 3.734 | 10.986 |
| tUdu | 437 | 1201 | 4.178 | 9.709 |
| tUdu | 458 | 1905 | 4.370 | 12.787 |
| tUdu | 523 | 1870 | 4.936 | 12.667 |
| kUzeh | 441 | 1661 | 4.220 | 11.883 |
| kUzinyah | 509 | 1784 | 4.812 | 12.358 |
| bUtika | 424 | 1649 | 4.060 | 11.834 |
| bUtika | 609 | 1921 | 5.658 | 12.843 |
| tUdu | 443 | 1349 | 4.237 | 10.484 |
| kUzinyah | 485 | 1253 | 4.606 | 9.993 |
| bUtika | 475 | 1435 | 4.519 | 10.903 |
| kUzinyah | 531 | 1336 | 5.007 | 10.420 |
| sUsi | 500 | 1685 | 4.736 | 11.977 |
| kUzeh | 484 | 1390 | 4.599 | 10.687 |
| fUbeh | 587 | 1771 | 5.478 | 12.310 |
| tUdu | 614 | 1047 | 5.701 | 8.806 |
| tUdu | 509 | 1562 | 4.814 | 11.472 |

## APPENDIX C8 - MPC /ɔ/ before /t/ and /d/ Environment

| /ot/ | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) |
|---|---|---|---|---|
| bOtah | 616.103 | 1274.96 | 5.717 | 10.106 |
| bOtak | 579.504 | 1389.57 | 5.414 | 10.685 |
| bOtah | 622.795 | 1302.07 | 5.771 | 10.248 |
| bOtah * | 625.957 | 1374.09 | 5.797 | 10.609 |
| bOtak | 584.39 | 1522.41 | 5.455 | 11.299 |
| bOtah | 595.965 | 1122.44 | 5.551 | 9.260 |
| bOtah | 648.749 | 1251.78 | 5.981 | 9.984 |
| bOtah | 607.306 | 1176.57 | 5.644 | 9.571 |
| bOtah | 552.654 | 1261.49 | 5.188 | 10.035 |
| bOtah | 654.645 | 1352.47 | 6.028 | 10.503 |
| bOtah | 630.459 | 1199.65 | 5.833 | 9.700 |
| bOtah | 607.709 | 1105.65 | 5.648 | 9.161 |
| bOtah | 627.162 | 1371.94 | 5.807 | 10.599 |
| bOttah | 607.208 | 1551.43 | 5.644 | 11.426 |
| bOtah | 517.014 | 2102.77 | 4.884 | 13.426 |
| bOtah | 571.765 | 1324.32 | 5.349 | 10.361 |
| bOtak | 601.791 | 1279.56 | 5.599 | 10.131 |
| bOtah | 633.158 | 1262.57 | 5.855 | 10.041 |

| /od/ | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) |
|---|---|---|---|---|
| pOdi | 462.834 | 1152.32 | 4.410 | 9.433 |
| pOdi | 432.921 | 1178.21 | 4.144 | 9.580 |
| pOdi | 549.978 | 1430.98 | 5.166 | 10.882 |
| pOdi | 440.004 | 1537.96 | 4.207 | 11.367 |
| mpOdi | 535.205 | 1220.76 | 5.040 | 9.816 |
| mpOdi | 511.599 | 1172.37 | 4.837 | 9.547 |
| pOdi | 522.793 | 1258.64 | 4.934 | 10.020 |
| mpOdi | 495.09 | 1248.37 | 4.694 | 9.965 |
| pOdi | 504.882 | 1207.95 | 4.779 | 9.746 |

| /o/ + others | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) |
|---|---|---|---|---|
| gOstah | 555.205 | 1622.05 | 5.210 | 11.724 |
| gOstah | 643.057 | 1612.89 | 5.935 | 11.686 |
| gOstah | 609.757 | 1768.34 | 5.665 | 12.299 |
| gOstah | 614.583 | 1455.46 | 5.704 | 10.997 |
| gOstah | 618.885 | 1617.74 | 5.739 | 11.706 |
| gOstah | 687.619 | 1546.96 | 6.290 | 11.406 |
| bOsa | 501.879 | 1100.96 | 4.753 | 9.133 |
| tOkah | 724.612 | 1230.41 | 6.577 | 9.869 |
| tOkah | 607.346 | 1162.9 | 5.645 | 9.493 |
| tOkah | 635.276 | 1153.86 | 5.873 | 9.442 |
| angkOza | 641.675 | 934.47 | 5.924 | 8.082 |
| tOkah | 768.29 | 1471.53 | 6.907 | 11.070 |
| gOstah | 678.503 | 981.008 | 6.218 | 8.388 |
| gOstah | 727.687 | 1111.93 | 6.600 | 9.198 |
| gOstah | 615.921 | 936.964 | 5.715 | 8.099 |
| gOstah | 749.717 | 1046.73 | 6.768 | 8.804 |
| repOstah | 695.949 | 1403.94 | 6.355 | 10.754 |
| angkOza | 759.417 | 1116.49 | 6.841 | 9.225 |
| tOkah | 696.028 | 1307.06 | 6.355 | 10.273 |
| tOkah | 726.322 | 1356.15 | 6.590 | 10.521 |
| tOkah | 760.697 | 1314.7 | 6.850 | 10.312 |
| tOkah | 656.964 | 1381.56 | 6.047 | 10.646 |
| bOka | 726.215 | 1069.2 | 6.589 | 8.942 |
| tOkah | 630.736 | 1257.94 | 5.836 | 10.016 |
| bOka | 603.625 | 990.108 | 5.614 | 8.447 |
| tOkah | 643.118 | 1373.48 | 5.936 | 10.606 |
| angkOza | 586.286 | 1239.17 | 5.471 | 9.916 |
| mpOku | 446.957 | 835.239 | 4.269 | 7.396 |
| kOku | 519.608 | 795.161 | 4.906 | 7.106 |
| mpOku | 595.753 | 922.355 | 5.549 | 8.001 |
| kOfi | 649.17 | 914.717 | 5.984 | 7.949 |

| | | | | |
|---|---|---|---|---|
| kOfi | 743.097 | 1030.19 | 6.718 | 8.701 |
| mpOku | 560.56 | 1766.05 | 5.255 | 12.290 |
| mpOku | 586.45 | 936.62 | 5.472 | 8.097 |
| mpOku | 596.244 | 929.323 | 5.553 | 8.048 |
| abOh | 533.565 | 923.439 | 5.026 | 8.008 |
| dOs | 440.156 | 1088.59 | 4.209 | 9.059 |
| abOh | 454.673 | 853.227 | 4.338 | 7.524 |
| abOh | 492.496 | 973.23 | 4.671 | 8.338 |
| abOh | 471.562 | 979.164 | 4.487 | 8.376 |
| bOs | 592.221 | 1282.18 | 5.520 | 10.144 |
| bOs | 584.275 | 1096.51 | 5.454 | 9.106 |
| bOsa | 581.782 | 1184.83 | 5.433 | 9.617 |
| bOs | 568.218 | 1227.56 | 5.320 | 9.853 |
| bOs | 462.736 | 1184.32 | 4.410 | 9.614 |
| bOs | 587.898 | 1205.43 | 5.484 | 9.732 |
| bOs | 512.928 | 896.726 | 4.849 | 7.827 |
| bOs | 621.038 | 888.714 | 5.757 | 7.772 |
| bOs | 568.357 | 1158.74 | 5.321 | 9.470 |
| bOs | 534.567 | 908.207 | 5.034 | 7.905 |
| bOs | 587.968 | 909.271 | 5.485 | 7.912 |
| bOs | 739.251 | 1415.81 | 6.688 | 10.811 |
| bOs | 513.381 | 905.89 | 4.852 | 7.889 |
| bOs | 475.774 | 888.44 | 4.525 | 7.770 |
| bOs | 480.473 | 967.448 | 4.566 | 8.300 |
| bOs | 516.448 | 1195.15 | 4.879 | 9.675 |
| bOs | 605.977 | 1422.88 | 5.633 | 10.844 |
| bOs | 498.012 | 1142.38 | 4.719 | 9.376 |
| dOs | 530.319 | 1070.34 | 4.998 | 8.949 |
| dOs | 496.451 | 934.475 | 4.706 | 8.082 |
| dOs | 560.611 | 1217.06 | 5.256 | 9.796 |
| dOs | 508.131 | 953.605 | 4.807 | 8.209 |
| dOs | 562.916 | 881.645 | 5.275 | 7.723 |

| | | | | |
|---|---|---|---|---|
| dOs | 604.596 | 950.226 | 5.622 | 8.187 |
| dOs | 512.816 | 1000.03 | 4.848 | 8.511 |
| dOh | 552.957 | 1358.41 | 5.191 | 10.532 |
| peskadOr | 522.935 | 959.675 | 4.935 | 8.249 |
| dOs | 498.526 | 939.455 | 4.724 | 8.116 |
| bOkeras corrected | 544.825 | 874.925 | 5.122 | 7.676 |
| kOku | 406.72 | 698.706 | 3.908 | 6.376 |
| kOku | 509.448 | 851.947 | 4.818 | 7.515 |
| bOs | 479.539 | 913.984 | 4.558 | 7.944 |
| bOs | 517.448 | 984.955 | 4.888 | 8.414 |
| bOs | 744.829 | 1792.33 | 6.731 | 12.388 |
| bOs | 707.749 | 1009.29 | 6.447 | 8.570 |
| dOs | 463.075 | 1613.97 | 4.413 | 11.691 |
| dOs | 491.54 | 1153.18 | 4.663 | 9.438 |
| dOs | 445.899 | 932.259 | 4.260 | 8.068 |
| bOs | 506.69 | 1031.1 | 4.795 | 8.707 |
| bOkeras | 604.876 | 929.031 | 5.624 | 8.046 |

## APPENDIX C9 - MPC /ɔ/ based on Vowel Height of following Vowels

| Followed by high vowel | | | | | |
|---|---|---|---|---|---|
| /od/ | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) | location |
| pOdi | 462.834 | 1152.32 | 4.410 | 9.433 | 363.566 |
| pOdi | 432.921 | 1178.21 | 4.144 | 9.580 | 365.151 |
| pOdi | 549.978 | 1430.98 | 5.166 | 10.882 | 180.692 |
| pOdi | 440.004 | 1537.96 | 4.207 | 11.367 | 68.0589 |
| pOdi | 522.793 | 1258.64 | 4.934 | 10.020 | 374.09 |
| pOdi | 504.882 | 1207.95 | 4.779 | 9.746 | 926.369 |
| | | | | | |
| mpOdi | 535.205 | 1220.76 | 5.040 | 9.816 | 289.58 |
| mpOdi | 511.599 | 1172.37 | 4.837 | 9.547 | 361.631 |
| mpOdi | 495.09 | 1248.37 | 4.694 | 9.965 | 395.284 |

| Followed by Low Vowel | | | | | |
|---|---|---|---|---|---|
| /ot/ | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) | location |
| bOtah | 616.103 | 1274.96 | 5.717 | 10.106 | 346.216 |
| bOtah | 622.795 | 1302.07 | 5.771 | 10.248 | 351.128 |
| bOtah * | 625.957 | 1374.09 | 5.797 | 10.609 | 353.261 |
| bOtah | 595.965 | 1122.44 | 5.551 | 9.260 | 767.451 |
| bOtah | 648.749 | 1251.78 | 5.981 | 9.984 | 960.481 |
| bOtah | 607.306 | 1176.57 | 5.644 | 9.571 | 999.62 |
| bOtah | 552.654 | 1261.49 | 5.188 | 10.035 | 1007.22 |
| bOtah | 654.645 | 1352.47 | 6.028 | 10.503 | 1010.1 |
| bOtah | 630.459 | 1199.65 | 5.833 | 9.700 | 1014.03 |
| bOtah | 607.709 | 1105.65 | 5.648 | 9.161 | 1017.48 |
| bOtah | 627.162 | 1371.94 | 5.807 | 10.599 | 1043.98 |
| bOttah | 607.208 | 1551.43 | 5.644 | 11.426 | 1053.87 |
| bOtah | 517.014 | 2102.77 | 4.884 | 13.426 | 1061.25 |
| bOtah | 571.765 | 1324.32 | 5.349 | 10.361 | 1069.54 |
| bOtah | 633.158 | 1262.57 | 5.855 | 10.041 | 1099.58 |

| | | | | | |
|---|---|---|---|---|---|
| bOtak | 579.504 | 1389.57 | 5.414 | 10.685 | 347.732 |
| bOtak | 584.39 | 1522.41 | 5.455 | 11.299 | 354.964 |
| bOtak | 601.791 | 1279.56 | 5.599 | 10.131 | 1071.31 |

## APPENDIX C10 - CV and CVC Syllables /a/ Vowels

| CV syllable | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) |
|---|---|---|---|---|
| ngkA | 832 | 1758 | 7.371 | 12.260 |
| ngkA | 804 | 1918 | 7.174 | 12.833 |
| ngkA | 658 | 1945 | 6.053 | 12.923 |
| fikAh | 857 | 1588 | 7.554 | 11.580 |
| gostAh | 831 | 1871 | 7.364 | 12.670 |
| kAh | 770 | 1901 | 6.921 | 12.776 |
| judAh | 782 | 1922 | 7.011 | 12.845 |
| dAh | 748 | 1966 | 6.754 | 12.994 |
| kAza | 812 | 1986 | 7.232 | 13.058 |
| kAza | 903 | 1837 | 7.867 | 12.549 |
| kA | 733 | 1482 | 6.642 | 11.117 |
| kAza | 893 | 1924 | 7.802 | 12.853 |
| gostAh | 733 | 1857 | 6.641 | 12.620 |
| gostAh | 782 | 1808 | 7.012 | 12.445 |
| gostAh | 741 | 1739 | 6.698 | 12.188 |
| chA | 963 | 1654 | 8.274 | 11.856 |
| ngkA | 780 | 1880 | 6.996 | 12.702 |
| gostAh | 859 | 1804 | 7.562 | 12.429 |
| fikAh | 706 | 1432 | 6.436 | 10.887 |
| jA | 518 | 1955 | 4.896 | 12.957 |
| jA(corrected) | 484 | 1818 | 4.593 | 12.481 |
| jA | 600 | 1645 | 5.581 | 11.819 |
| ngkA | 511 | 1960 | 4.829 | 12.973 |
| ngkA | 443 | 1688 | 4.236 | 11.992 |
| sestA | 593 | 1671 | 5.528 | 11.924 |
| sestAfera | 451 | 1669 | 4.307 | 11.917 |
| sestAfera | 496 | 1790 | 4.700 | 12.379 |
| chA | 826 | 1598 | 7.330 | 11.622 |
| kazA | 788 | 1512 | 7.055 | 11.253 |

| | | | | |
|---|---|---|---|---|
| ngkA | 497 | 1744 | 4.711 | 12.206 |
| kabAh | 626 | 1455 | 5.794 | 10.997 |
| botAh | 795 | 1625 | 7.105 | 11.738 |
| jA | 466 | 2166 | 4.438 | 13.615 |
| fikAh | 817 | 1861 | 7.264 | 12.633 |
| kazAh | 877 | 1717 | 7.688 | 12.102 |
| kabAh | 683 | 1696 | 6.257 | 12.023 |
| kazAh | 953 | 1860 | 8.204 | 12.632 |
| mpustAh | 786 | 1539 | 7.042 | 11.372 |
| tokAh | 978 | 1463 | 8.366 | 11.033 |
| kabAh | 644 | 1416 | 5.944 | 10.810 |
| pagAh | 909 | 1528 | 7.913 | 11.321 |
| ngkA | 628 | 1860 | 5.814 | 12.631 |
| kabAh | 760 | 1675 | 6.842 | 11.937 |
| tokAh | 653 | 1032 | 6.017 | 8.710 |
| fikAh | 871 | 1758 | 7.649 | 12.258 |
| botAh | 929 | 1701 | 8.042 | 12.041 |
| lebAh | 645 | 1505 | 5.948 | 11.222 |
| kabAh | 532 | 1482 | 5.009 | 11.119 |
| fikAh | 553 | 2150 | 5.191 | 13.568 |
| kabAh | 596 | 596 | 5.547 | 5.547 |
| jA | 573 | 1831 | 5.357 | 12.530 |
| fikAh | 834 | 1749 | 7.388 | 12.226 |
| jA | 589 | 1912 | 5.491 | 12.811 |
| jA | 541 | 2134 | 5.092 | 13.519 |
| kazAh | 901 | 1550 | 7.859 | 11.421 |
| ngkA | 529 | 1724 | 4.985 | 12.130 |
| ngkA | 743 | 1739 | 6.714 | 12.186 |
| ngkA | 700 | 1830 | 6.389 | 12.524 |
| jA | 540 | 1769 | 5.077 | 12.302 |
| kabAh | 591 | 1920 | 5.513 | 12.840 |
| jA | 556 | 2153 | 5.220 | 13.578 |

| | | | | |
|---|---|---|---|---|
| kazAh | 849 | 1607 | 7.492 | 11.663 |
| kazAh | 814 | 1562 | 7.246 | 11.473 |
| fikAh | 772 | 1824 | 6.931 | 12.504 |
| jA | 628 | 2049 | 5.812 | 13.261 |
| kazAh | 837 | 1526 | 7.410 | 11.317 |
| tA | 609 | 1799 | 5.659 | 12.410 |
| fikAh | 652 | 1835 | 6.010 | 12.541 |
| fikAh | 724 | 2104 | 6.572 | 13.430 |
| jA | 564 | 1960 | 5.287 | 12.973 |
| jA | 703 | 1712 | 6.412 | 12.084 |
| jA | 452 | 2194 | 4.312 | 13.696 |
| jA | 461 | 2119 | 4.391 | 13.477 |
| jA | 556 | 1981 | 5.213 | 13.044 |
| jA | 660 | 1905 | 6.073 | 12.787 |
| jA | 611 | 2068 | 5.673 | 13.318 |
| ngkA | 636 | 1315 | 5.876 | 10.316 |
| ngkA | 601 | 1290 | 5.593 | 10.187 |
| jA | 579 | 690 | 5.412 | 6.311 |
| tA | 1142 | 1521 | 9.374 | 11.292 |
| jA | 438 | 2004 | 4.188 | 13.117 |
| kabAh | 841 | 1563 | 7.436 | 11.475 |
| jA | 511 | 2059 | 4.834 | 13.290 |
| kA di tras | 666 | 1959 | 6.117 | 12.970 |
| jA | 780 | 1651 | 6.994 | 11.841 |
| jA | 549 | 2037 | 5.154 | 13.222 |
| jA | 546 | 2063 | 5.129 | 13.304 |
| jA | 503 | 2045 | 4.766 | 13.248 |
| tA | 638 | 1617 | 5.892 | 11.705 |
| kabAh | 680 | 1677 | 6.230 | 11.948 |
| sAkumih | 646 | 1734 | 5.955 | 12.170 |
| kazA | 685 | 2070 | 6.267 | 13.327 |
| ngkA | 623 | 1187 | 5.772 | 9.632 |

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|---|---|---|---|---|
| butikA | 530 | 2122 | 4.993 | 13.485 |
| kazA | 600 | 1740 | 5.585 | 12.192 |
| kabAh | 762 | 1677 | 6.861 | 11.945 |
| jA | 458 | 2134 | 4.370 | 13.521 |
| tokAh | 604 | 1165 | 5.621 | 9.507 |
| butikA | 600 | 1122 | 5.585 | 9.256 |
| ngkA | 675 | 1447 | 6.189 | 10.958 |
| kazAh | 910 | 1369 | 7.917 | 10.586 |
| tA | 621 | 2099 | 5.757 | 13.414 |
| fikAh | 562 | 1313 | 5.264 | 10.303 |
| tokAh | 594 | 1192 | 5.534 | 9.655 |
| tA | 456 | 1611 | 4.352 | 11.679 |
| fikAh | 462 | 1328 | 4.399 | 10.380 |
| ngkA | 744 | 1381 | 6.721 | 10.645 |
| gostAh | 602 | 1958 | 5.602 | 12.967 |
| gostAh | 754 | 1685 | 6.797 | 11.980 |
| achAh | 1028 | 1686 | 8.691 | 11.981 |
| achAh | 524 | 1559 | 4.942 | 11.458 |
| gostAh | 666 | 1215 | 6.117 | 9.783 |
| gostAh | 895 | 1717 | 7.812 | 12.103 |
| jA | 580 | 2241 | 5.421 | 13.829 |
| ngkA | 555 | 1105 | 5.207 | 9.157 |
| ngkA | 685 | 1446 | 6.266 | 10.953 |
| botAh | 970 | 1660 | 8.319 | 11.878 |
| kabAh | 697 | 1765 | 6.364 | 12.288 |
| sA | 653 | 1411 | 6.015 | 10.789 |
| kazA | 591 | 1504 | 5.513 | 11.216 |
| portA | 810 | 1855 | 7.215 | 12.615 |
| jA | 471 | 1737 | 4.483 | 12.181 |
| fikAh | 653 | 1487 | 6.017 | 11.143 |
| fikAh | 643 | 1496 | 5.931 | 11.179 |
| sA | 688 | 1706 | 6.292 | 12.061 |

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|---|---|---|---|---|
| sA | 602 | 1524 | 5.597 | 11.307 |
| tA | 730 | 1742 | 6.614 | 12.201 |
| ngkA | 665 | 1544 | 6.111 | 11.392 |
| kabAh | 908 | 1746 | 7.901 | 12.215 |
| tA | 647 | 1404 | 5.970 | 10.756 |
| ngkA | 798 | 1703 | 7.129 | 12.048 |
| sA | 521 | 1873 | 4.917 | 12.678 |
| sA | 592 | 1886 | 5.516 | 12.723 |
| sA | 652 | 1234 | 6.010 | 9.886 |
| sA | 735 | 1902 | 6.656 | 12.776 |
| jA | 505 | 1734 | 4.783 | 12.170 |
| kabAh | 599 | 1289 | 5.578 | 10.178 |
| judAh | 634 | 1533 | 5.865 | 11.347 |
| kabAh | 542 | 1179 | 5.100 | 9.583 |
| jA | 517 | 1955 | 4.886 | 12.958 |
| fikAh | 600 | 1474 | 5.587 | 11.083 |
| jA | 560 | 1702 | 5.248 | 12.046 |
| kazAh | 804 | 1125 | 7.173 | 9.275 |
| jA | 445 | 1833 | 4.250 | 12.536 |
| kazAh | 692 | 1625 | 6.322 | 11.737 |
| sA | 560 | 1860 | 5.248 | 12.631 |
| sA | 586 | 1357 | 5.466 | 10.526 |
| jA corrected | 501 | 2136 | 4.741 | 13.525 |
| jA | 464 | 1797 | 4.421 | 12.405 |
| kazAh | 618 | 1824 | 5.735 | 12.503 |
| jA | 582 | 1796 | 5.435 | 12.403 |
| jA | 509 | 2026 | 4.817 | 13.186 |
| kabAh | 559 | 1195 | 5.240 | 9.675 |
| achAh | 577 | 1615 | 5.393 | 11.697 |
| jA | 504 | 1695 | 4.772 | 12.018 |
| kabAh | 566 | 1224 | 5.301 | 9.834 |
| achAh | 649 | 1670 | 5.986 | 11.920 |

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|---|---|---|---|---|
| kabAh | 622 | 1350 | 5.761 | 10.490 |
| achAh | 578 | 1453 | 5.398 | 10.983 |
| jA | 523 | 1679 | 4.938 | 11.955 |
| jA | 523 | 1679 | 4.938 | 11.955 |
| dA | 583 | 1535 | 5.444 | 11.356 |
| dAh | 636 | 1537 | 5.882 | 11.363 |
| jA | 533 | 1810 | 5.019 | 12.454 |
| jA | 468 | 1953 | 4.454 | 12.951 |
| tA | 605 | 1266 | 5.628 | 10.057 |
| jA | 475 | 1597 | 4.522 | 11.621 |
| jA | 595 | 1446 | 5.543 | 10.952 |
| jA | 541 | 1618 | 5.089 | 11.706 |
| kabAh | 530 | 1229 | 4.995 | 9.859 |
| dAh | 830 | 1698 | 7.359 | 12.028 |
| jA | 525 | 2082 | 4.952 | 13.362 |
| kazAh | 674 | 1422 | 6.185 | 10.838 |
| jA corrected | 514 | 1787 | 4.854 | 12.369 |
| jA | 552 | 1267 | 5.180 | 10.066 |
| jA | 475 | 1505 | 4.517 | 11.220 |
| jA | 563 | 1763 | 5.272 | 12.279 |
| fikAh | 724 | 1405 | 6.568 | 10.757 |
| jA | 548 | 1595 | 5.145 | 11.611 |
| kabAh | 667 | 1584 | 6.125 | 11.565 |
| jA | 523 | 1807 | 4.931 | 12.442 |
| kabAh | 570 | 1316 | 5.330 | 10.319 |
| jA | 494 | 1845 | 4.686 | 12.579 |
| kazAh | 756 | 1666 | 6.815 | 11.904 |
| jA | 552 | 1994 | 5.186 | 13.084 |
| kabAh | 598 | 1153 | 5.567 | 9.438 |
| ngkA | 489 | 1452 | 4.638 | 10.979 |
| kabAh | 807 | 1298 | 7.191 | 10.226 |
| kazAh | 834 | 1418 | 7.390 | 10.820 |

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|---|---|---|---|---|
| jA | 589 | 1531 | 5.491 | 11.335 |
| fikAh | 721 | 1657 | 6.547 | 11.866 |
| jA | 578 | 2047 | 5.401 | 13.253 |
| kabAh | 616 | 1203 | 5.715 | 9.717 |
| fikAh | 815 | 1468 | 7.249 | 11.054 |
| pegAh | 624 | 1449 | 5.780 | 10.965 |
| pegAh | 759 | 1596 | 6.841 | 11.618 |
| jA | 562 | 1817 | 5.271 | 12.479 |
| kabAh | 539 | 1262 | 5.070 | 10.039 |
| mandAh | 614 | 1755 | 5.695 | 12.250 |
| jA | 538 | 1825 | 5.064 | 12.505 |
| kazAh | 873 | 1587 | 7.665 | 11.577 |
| jA | 641 | 1397 | 5.920 | 10.721 |
| tokAh | 680 | 1444 | 6.226 | 10.942 |
| kazAh | 666 | 1331 | 6.115 | 10.397 |
| ngkA | 551 | 1623 | 5.177 | 11.728 |
| kazAh | 816 | 1470 | 7.257 | 11.063 |
| tokAh | 699 | 1231 | 6.378 | 9.873 |
| fikAh | 769 | 1636 | 6.911 | 11.780 |
| kazAh | 763 | 1305 | 6.865 | 10.260 |
| kabAh | 774 | 1442 | 6.952 | 10.933 |
| kabAh | 659 | 1323 | 6.064 | 10.354 |
| lantAh | 721 | 1577 | 6.548 | 11.538 |
| lantAh | 870 | 1600 | 7.643 | 11.631 |
| jA | 512 | 2078 | 4.837 | 13.350 |
| kabAh | 561 | 1219 | 5.258 | 9.805 |
| kabAh | 560 | 1053 | 5.254 | 8.845 |
| fikAh | 683 | 1709 | 6.255 | 12.071 |
| tokAh | 612 | 1377 | 5.684 | 10.622 |
| santAh | 829 | 1433 | 7.349 | 10.890 |
| andAh | 785 | 1459 | 7.033 | 11.011 |
| botAh | 647 | 1431 | 5.963 | 10.881 |

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|---|---|---|---|---|
| botAh | 893 | 1590 | 7.799 | 11.589 |
| desAh | 621 | 1501 | 5.753 | 11.203 |
| botAh | 898 | 1464 | 7.834 | 11.036 |
| botAh | 807 | 1554 | 7.191 | 11.437 |
| kortAh | 706 | 1379 | 6.433 | 10.632 |
| kortAh | 565 | 1276 | 5.295 | 10.112 |
| lantAh | 851 | 1550 | 7.510 | 11.418 |
| kabAh | 612 | 1228 | 5.684 | 9.855 |
| botAh | 590 | 1331 | 5.502 | 10.397 |
| botAh | 598 | 1596 | 5.568 | 11.616 |
| botAh | 689 | 1701 | 6.302 | 12.041 |
| sAtenta | 700 | 1838 | 6.387 | 12.554 |
| sAtenta | 738 | 1992 | 6.681 | 13.078 |
| pApiah | 713 | 1574 | 6.484 | 11.521 |
| pApiah | 715 | 1477 | 6.505 | 11.097 |
| pApiah | 735 | 1548 | 6.659 | 11.413 |
| kAkeli | 678 | 1887 | 6.210 | 12.725 |
| pApiah | 713 | 1568 | 6.489 | 11.498 |
| sAbeh | 661 | 1876 | 6.081 | 12.688 |
| tAbeng | 548 | 1883 | 5.145 | 12.714 |
| bAzar | 783 | 1902 | 7.014 | 12.779 |
| bAzar | 758 | 1841 | 6.827 | 12.565 |
| fAzeh | 694 | 1886 | 6.340 | 12.723 |
| pAdikumih | 726 | 1997 | 6.586 | 13.094 |
| fAzeh | 651 | 1896 | 5.999 | 12.756 |
| fAzeh | 678 | 1813 | 6.213 | 12.464 |
| fAzeh | 594 | 1965 | 5.531 | 12.991 |
| sAbontadi | 603 | 1864 | 5.606 | 12.646 |
| bontAdi | 869 | 1979 | 7.638 | 13.037 |
| pApiah | 735 | 1572 | 6.657 | 11.513 |
| pApiah | 778 | 1598 | 6.982 | 11.623 |
| pApiah | 754 | 1515 | 6.797 | 11.266 |

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|---|---|---|---|---|
| pApiah | 837 | 1526 | 7.407 | 11.317 |
| pApiah | 728 | 1489 | 6.601 | 11.149 |
| fAzeh | 811 | 1767 | 7.220 | 12.295 |
| idAdi | 819 | 1715 | 7.278 | 12.097 |
| sAtenta | 762 | 1728 | 6.862 | 12.146 |
| kAza | 806 | 1673 | 7.186 | 11.930 |
| idAdi | 798 | 1818 | 7.129 | 12.481 |
| pApiah | 745 | 1528 | 6.735 | 11.322 |
| idAdi | 791 | 1754 | 7.077 | 12.245 |
| pApiah | 644 | 1459 | 5.942 | 11.015 |
| sAbeh | 790 | 1529 | 7.066 | 11.327 |
| pApiah | 701 | 1525 | 6.396 | 11.310 |
| pApiah | 692 | 1624 | 6.320 | 11.731 |
| kAza | 899 | 1588 | 7.842 | 11.583 |
| pApiah | 791 | 1431 | 7.076 | 10.884 |
| pApiah | 707 | 1434 | 6.441 | 10.899 |
| sAbeh | 903 | 1734 | 7.868 | 12.170 |
| pApiah | 789 | 1673 | 7.064 | 11.931 |
| pApiah | 720 | 1507 | 6.544 | 11.229 |
| kAzamintu | 667 | 1611 | 6.129 | 11.678 |
| kAzamintu | 668 | 1644 | 6.138 | 11.813 |
| bAtatə | 800 | 1647 | 7.138 | 11.824 |
| batAtə | 823 | 1702 | 7.310 | 12.044 |
| kAza | 830 | 1578 | 7.359 | 11.541 |
| pAdri | 891 | 1486 | 7.788 | 11.136 |
| sAfrang | 858 | 1647 | 7.556 | 11.828 |
| kAbah | 703 | 1531 | 6.411 | 11.338 |
| kAbəh | 668 | 1563 | 6.136 | 11.474 |
| atApə | 944 | 1599 | 8.146 | 11.630 |
| pApiah | 842 | 1435 | 7.443 | 10.902 |
| kAzah | 835 | 1683 | 7.396 | 11.972 |
| sAbeh | 932 | 1538 | 8.065 | 11.369 |

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|---|---|---|---|---|
| pApiah | 853 | 1400 | 7.519 | 10.735 |
| pApiah | 828 | 1381 | 7.343 | 10.641 |
| sAbeh | 837 | 1983 | 7.410 | 13.050 |
| pApiah | 970 | 1517 | 8.315 | 11.277 |
| kAza | 909 | 1745 | 7.908 | 12.212 |
| pApiah | 877 | 1468 | 7.693 | 11.055 |
| kAbah | 718 | 1665 | 6.524 | 11.899 |
| kAzah | 937 | 1830 | 8.098 | 12.525 |
| kAza | 1114 | 1617 | 9.210 | 11.702 |
| kAbah | 797 | 1488 | 7.120 | 11.147 |
| pAgah | 589 | 2344 | 5.496 | 14.112 |
| sAbeh | 906 | 1653 | 7.890 | 11.851 |
| pApiah | 800 | 1540 | 7.142 | 11.375 |
| pApiah | 861 | 1467 | 7.578 | 11.048 |
| kAbah | 691 | 1354 | 6.319 | 10.509 |
| pAderi | 1021 | 1554 | 8.641 | 11.439 |
| kAza | 912 | 1759 | 7.930 | 12.263 |
| fAzeh | 801 | 1647 | 7.151 | 11.827 |
| kAza | 867 | 1661 | 7.620 | 11.885 |
| fAzeh | 860 | 1706 | 7.574 | 12.060 |
| fAzeh | 842 | 1604 | 7.443 | 11.649 |
| fAzeh | 811 | 1602 | 7.221 | 11.639 |
| pApiah | 954 | 1535 | 8.214 | 11.356 |
| pApiah | 845 | 1376 | 7.463 | 10.617 |
| sAbeh | 949 | 1591 | 8.181 | 11.596 |
| pApiah | 942 | 1510 | 8.132 | 11.242 |
| pApiah | 855 | 1425 | 7.534 | 10.854 |
| pApiah | 996 | 1674 | 8.482 | 11.935 |
| pApiah | 844 | 1564 | 7.459 | 11.480 |
| pApiah | 868 | 1454 | 7.627 | 10.988 |
| pApiah | 953 | 1543 | 8.206 | 11.391 |
| sAbeh | 1006 | 2019 | 8.551 | 13.166 |

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|---|---|---|---|---|
| pAderi | 871 | 1839 | 7.652 | 12.557 |
| kAbah | 609 | 1696 | 5.661 | 12.023 |
| bAtatə | 909 | 1637 | 7.911 | 11.787 |
| batAtə | 931 | 1799 | 8.060 | 12.411 |
| kAbah | 605 | 981 | 5.622 | 8.391 |
| fAzeh | 767 | 1745 | 6.895 | 12.212 |
| idAdi | 877 | 1771 | 7.688 | 12.309 |
| pAdri | 773 | 1568 | 6.944 | 11.499 |
| pApiah | 696 | 1425 | 6.354 | 10.856 |
| kAzah | 913 | 1664 | 7.935 | 11.893 |
| pApiah | 733 | 1360 | 6.638 | 10.538 |
| pApiah | 748 | 1455 | 6.756 | 10.995 |
| pApiah | 675 | 1560 | 6.192 | 11.461 |
| kAbah | 654 | 1679 | 6.022 | 11.955 |
| pApiah | 686 | 1278 | 6.279 | 10.121 |
| pApiah | 726 | 1320 | 6.590 | 10.340 |
| pApiah | 699 | 1507 | 6.379 | 11.229 |
| sAbeh | 736 | 1577 | 6.664 | 11.537 |
| sAbeh | 744 | 1682 | 6.723 | 11.965 |
| pApiah | 748 | 1700 | 6.754 | 12.036 |
| yosA | 550 | 1638 | 5.162 | 11.791 |
| kAbah | 690 | 1755 | 6.305 | 12.249 |
| kAzah | 846 | 1829 | 7.473 | 12.520 |
| kAzah | 868 | 1694 | 7.628 | 12.014 |
| tAfikah | 555 | 1979 | 5.209 | 13.035 |
| tAfikah | 719 | 1709 | 6.530 | 12.073 |
| kAzah | 822 | 1282 | 7.300 | 10.142 |
| pAdri | 757 | 1578 | 6.821 | 11.538 |
| kAbah | 601 | 1794 | 5.596 | 12.392 |
| kAbah | 574 | 1675 | 5.367 | 11.938 |
| kAza | 1005 | 1757 | 8.545 | 12.255 |
| kAbah | 653 | 1706 | 6.016 | 12.061 |

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|---|---|---|---|---|
| kAbah | 656 | 1862 | 6.040 | 12.638 |
| fAzeh | 675 | 1713 | 6.191 | 12.088 |
| fAzeh | 620 | 1939 | 5.752 | 12.903 |
| pApiah | 866 | 1568 | 7.615 | 11.497 |
| kAzə | 864 | 1708 | 7.603 | 12.068 |
| pApiah | 710 | 1444 | 6.463 | 10.944 |
| pApiah | 698 | 1175 | 6.375 | 9.563 |
| pApiah | 673 | 1239 | 6.178 | 9.917 |
| kAza | 1022 | 1651 | 8.650 | 11.843 |
| pApiah | 714 | 1409 | 6.495 | 10.776 |
| pApiah | 663 | 1410 | 6.094 | 10.783 |
| pApiah | 757 | 1228 | 6.820 | 9.853 |
| pAdri | 779 | 1690 | 6.985 | 11.998 |
| kAbah | 802 | 1626 | 7.158 | 11.742 |
| kAbah | 724 | 1369 | 6.570 | 10.585 |
| kAbah | 701 | 1673 | 6.398 | 11.931 |
| kAbah | 805 | 1608 | 7.176 | 11.664 |
| kAza | 934 | 1575 | 8.080 | 11.527 |
| kAza | 956 | 1420 | 8.227 | 10.830 |
| kAza | 957 | 1659 | 8.234 | 11.875 |
| kAza | 866 | 1874 | 7.613 | 12.680 |
| kAbah | 782 | 1684 | 7.006 | 11.975 |
| kAbah | 821 | 1677 | 7.293 | 11.946 |
| kAbah | 638 | 1514 | 5.898 | 11.261 |
| jA | 471 | 2194 | 4.482 | 13.697 |
| kAzah | 1038 | 1294 | 8.751 | 10.206 |
| pAda | 656 | 1446 | 6.039 | 10.954 |
| fAsel | 925 | 1514 | 8.022 | 11.262 |
| fAzeh | 580 | 1761 | 5.416 | 12.270 |
| fAzeh | 682 | 1700 | 6.246 | 12.036 |
| pAdeh | 728 | 1481 | 6.600 | 11.116 |
| sAbola | 899 | 1297 | 7.844 | 10.222 |

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|---|---|---|---|---|
| sAfrang | 902 | 1467 | 7.866 | 11.048 |
| kAbah | 608 | 1161 | 5.648 | 9.484 |
| pApiah | 808 | 1573 | 7.198 | 11.517 |
| kAza | 765 | 1275 | 6.879 | 10.107 |
| pApiah | 824 | 1192 | 7.317 | 9.659 |
| pApiah | 785 | 1195 | 7.028 | 9.672 |
| pApiah | 756 | 1238 | 6.819 | 9.909 |
| chAdu | 972 | 1487 | 8.331 | 11.143 |
| pApiah | 873 | 1205 | 7.661 | 9.732 |
| pApiah | 698 | 1175 | 6.372 | 9.564 |
| pApiah | 880 | 1671 | 7.712 | 11.924 |
| pApiah | 886 | 1480 | 7.750 | 11.111 |
| kAza | 923 | 1539 | 8.006 | 11.371 |
| pApiah | 820 | 1418 | 7.284 | 10.822 |
| pApiah | 805 | 1441 | 7.176 | 10.930 |
| pApiah | 849 | 1479 | 7.496 | 11.105 |
| kAbah | 764 | 1836 | 6.875 | 12.545 |
| chAdu | 1020 | 1795 | 8.638 | 12.398 |
| chAdu | 872 | 1511 | 7.659 | 11.250 |
| pApiah | 671 | 1259 | 6.156 | 10.024 |
| pApiah | 816 | 1348 | 7.257 | 10.480 |
| pApiah | 896 | 1425 | 7.824 | 10.853 |
| pApiah | 645 | 1112 | 5.949 | 9.200 |
| pApiah | 658 | 1655 | 6.059 | 11.858 |
| kAbah | 614 | 1879 | 5.699 | 12.699 |
| pApiah | 778 | 1169 | 6.983 | 9.530 |
| sAtenta | 783 | 1678 | 7.016 | 11.950 |
| pAdri | 819 | 1542 | 7.277 | 11.386 |
| kAda | 696 | 1674 | 6.356 | 11.933 |
| fAzeh | 583 | 1609 | 5.440 | 11.670 |
| fAzeh | 748 | 1565 | 6.755 | 11.484 |
| fAzeh | 698 | 1589 | 6.375 | 11.585 |

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|---|---|---|---|---|
| kAbah | 631 | 1287 | 5.836 | 10.168 |
| kAbah | 599 | 1286 | 5.577 | 10.163 |
| pApiah | 741 | 1420 | 6.704 | 10.833 |
| idAdi | 790 | 1723 | 7.064 | 12.127 |
| kAbah | 659 | 1328 | 6.066 | 10.379 |
| kAzah | 774 | 1623 | 6.953 | 11.726 |
| kAzah | 717 | 1708 | 6.516 | 12.067 |
| kAbah | 665 | 1169 | 6.114 | 9.529 |
| kAzah | 758 | 1593 | 6.829 | 11.605 |
| kAbah | 759 | 1365 | 6.837 | 10.564 |
| kAbah | 741 | 1371 | 6.705 | 10.596 |
| kAbah | 681 | 1346 | 6.241 | 10.470 |
| kAbah | 657 | 1299 | 6.044 | 10.232 |
| kAbah | 657 | 1299 | 6.044 | 10.232 |
| kAza | 894 | 1516 | 7.806 | 11.272 |
| atAdi | 728 | 1628 | 6.603 | 11.747 |
| kAzə | 802 | 1599 | 7.154 | 11.629 |
| idAdi | 793 | 1622 | 7.091 | 11.724 |
| kAbah | 722 | 1288 | 6.560 | 10.174 |
| kAzah | 770 | 1652 | 6.917 | 11.847 |
| pAda | 654 | 1746 | 6.023 | 12.215 |
| kAbah | 588 | 1279 | 5.487 | 10.129 |
| kAbah | 703 | 1356 | 6.413 | 10.521 |
| kAzah | 854 | 1586 | 7.529 | 11.573 |
| sAbeh | 760 | 1432 | 6.846 | 10.885 |
| kAbah | 736 | 1329 | 6.662 | 10.386 |
| sAbeh | 550 | 1327 | 5.168 | 10.376 |
| sAbeh | 714 | 1472 | 6.495 | 11.071 |
| kAbah | 813 | 1304 | 7.234 | 10.258 |
| kAzah | 874 | 1559 | 7.673 | 11.458 |
| fAzeh | 780 | 1593 | 6.993 | 11.602 |
| kAbah | 746 | 1280 | 6.737 | 10.134 |

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|---|---|---|---|---|
| kAzə | 855 | 1520 | 7.537 | 11.288 |
| kAbah | 757 | 1444 | 6.822 | 10.944 |
| pApiah | 697 | 1380 | 6.366 | 10.640 |
| fAzeh | 722 | 1695 | 6.557 | 12.018 |
| kAzah | 864 | 1584 | 7.598 | 11.567 |
| rondAdi | 829 | 1603 | 7.354 | 11.644 |
| fAzeh | 737 | 1788 | 6.674 | 12.370 |
| kAzah | 811 | 1552 | 7.219 | 11.427 |
| fAzeh | 774 | 1618 | 6.951 | 11.705 |
| sAbeh | 740 | 1368 | 6.697 | 10.577 |
| kAzah | 907 | 1410 | 7.896 | 10.783 |
| fAzeh | 735 | 1530 | 6.656 | 11.333 |
| kAzah | 815 | 1419 | 7.249 | 10.826 |
| kAzah | 855 | 1444 | 7.536 | 10.941 |
| fAzeh | 742 | 1686 | 6.710 | 11.981 |
| chAdu | 955 | 1354 | 8.219 | 10.510 |
| kAbah | 865 | 1456 | 7.609 | 11.000 |
| fAzeh | 758 | 1562 | 6.829 | 11.470 |
| kAbah | 721 | 1404 | 6.552 | 10.752 |
| kAza | 856 | 1567 | 7.542 | 11.491 |
| kAza | 752 | 1525 | 6.784 | 11.312 |
| fAzeh | 724 | 1654 | 6.569 | 11.855 |
| kAbah | 734 | 1367 | 6.648 | 10.576 |
| kAza | 826 | 1473 | 7.333 | 11.076 |
| kAza | 794 | 1450 | 7.095 | 10.973 |
| kAbah | 663 | 1212 | 6.094 | 9.768 |
| kAza | 801 | 1589 | 7.152 | 11.586 |
| kAza | 796 | 1605 | 7.114 | 11.652 |
| fAzeh | 677 | 1582 | 6.208 | 11.555 |
| fAzeh | 728 | 1566 | 6.606 | 11.488 |
| fAzeh | 657 | 1466 | 6.049 | 11.047 |
| kAbah | 645 | 1493 | 5.952 | 11.168 |

| | | | | |
|---|---|---|---|---|
| sAbola | 787 | 1416 | 7.045 | 10.809 |
| fAzeh | 584 | 1671 | 5.449 | 11.922 |
| artApal | 851 | 1367 | 7.505 | 10.573 |
| artApal | 836 | 1629 | 7.400 | 11.754 |
| artApal | 762 | 1605 | 6.860 | 11.652 |
| artApal | 805 | 1566 | 7.176 | 11.490 |
| artApal | 761 | 1416 | 6.854 | 10.812 |
| kAbah | 692 | 1330 | 6.323 | 10.388 |
| artApal | 885 | 1431 | 7.746 | 10.883 |
| artApal | 790 | 1560 | 7.066 | 11.462 |
| kAbah | 638 | 1334 | 5.892 | 10.412 |
| artApal | 878 | 1319 | 7.694 | 10.333 |
| sAbola | 828 | 1317 | 7.347 | 10.322 |

| /a/CVCsyllable | F1 (Hz) | F2 (Hz) | F1 (Bark) | F2 (Bark) |
|---|---|---|---|---|
| sAbdu | 983 | 1735 | 8.400 | 12.172 |
| karipAp | 905 | 1670 | 7.881 | 11.918 |
| sAbdu | 958 | 1499 | 8.239 | 11.197 |
| sAbdu | 986 | 1559 | 8.418 | 11.460 |