VOWELS IN MALACCA PORTUGUESE CREOLE

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Abstract
This paper examines the vowel system of present day Malacca Portuguese Creole (MPC) or *Kristang*, based on recordings from interviews with five female native speakers of MPC. A total of 1083 monophthongs were extracted from the recordings. The first and second formants of these vowels were measured and analysed. Considerable variation was found within and between the speakers 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. Based on the variation in the way that vowels are produced, and the overlaps between vowels, the findings suggest the possibility of phonological instability of this endangered language.

Key words: Malacca Portuguese Creole (MPC), *Kristang*, vowels, acoustic analysis

1. Background

The result of unions between the Portuguese, their camp followers[1] and locals in the 16th 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".

[1] When Malacca was conquered, there was a huge number of Indians amongst the army that they had amassed in Cochin. There were also converts from the local Indian merchant community who were given Portuguese surnames.

The following centuries saw further mixture with "Chinese, Indian, Malay, Dutch, Sri Lankan, Filipino and English elements" (Baxter, 2012, p. 115). These luso-descendants are referred to variously as: *Serani*, Eurasians, Portuguese, *Kristang* (which refers to Christianity, and is also used to refer to the language) and Portuguese-Eurasians (Fernandis, 2003).

Kristang or Malacca Portuguese Creole (MPC) is still used in the Portuguese Settlement located in Malacca, in the central region of Peninsular Malaysia. Formed by two Catholic priests, Rev. Father Alvaro Martin Coroado and Rev. Father Jules Pierre François, Portuguese descendants who used to live in other areas of Malacca were housed together, and it was known as *Padri Sa Chang* (O'Neill, 2008, p. 4) which translates to 'the priest's land'. Now, commonly known as the Portuguese Settlement, or *Kampong Portugis* in Malay (see Figure 1), the Settlement has approximately 1000 residents (personal communication with the head of the village committee).

Figure 1. Sign at the entrance of the Portuguese Settlement.

However, even in this concentrated area of speakers, there is evidence of language shift from MPC to English especially among younger speakers (e.g. David & Mohd Noor, 1999), 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; Pillai, Soh, & Yusuf, 2015). 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", which however, is in danger of dying out.

As the Portuguese formed unions with the locals in Malacca, and had children, the younger generations began to speak a form of Portuguese creole as their native language, and it continued to be passed on from one generation to another. Having evolved in a multilingual setting, the vocabulary and grammar of MPC is also influenced by Malay and other local languages (Baxter, 1990).

In relation to its sound system there is a lack of consistency in the description of MPC sounds perhaps due to the largely impressionistic analysis of the sounds. The multilingual context of Malaysia and the decreasing use of MPC are likely to influence the sounds of MPC over time. The present study, therefore, aims to instrumentally examine one part of the sound system of present day MPC spoken at the Portuguese Settlement. The present study focuses specifically on examining the monophthong vowels of MPC. In particular, it aims to examine the characteristics of monophthong vowels in MPC based on their acoustic properties.

2. Malacca Portuguese creole sounds

Baxter (1988) and Hancock (2009) describe MPC as having eight vowels, but the latter says that only six of them are contrastive. These MPC vowels are /i/, /e/-/ɛ/, /a/, /ɔ/-/o/, /u/ and /ə/[2] (Hancock, 2009, p. 298). However, the status of /e/, /ɛ/, /ɔ/ and /o/ are not clear. They are said to be contrastive and, therefore, it could be assumed that they are separate phonemes in MPC, and occur in minimal pairs. However, Hancock (2009, p. 298) only explains the contrast for /e/ - /ɛ/, saying that these vowels are contrastive only for two words "pétu ([pɛtu]), 'chest, breast', and pétu ([petu]), 'near' (Ptg. peito and perto)". Hancock orthographically represents both /ɛ/ and /e/ as <e>, while in Baxter and de Silva (2004, p. xii), the circumflex accent <ê> is used to differentiate the two vowels in the orthography of some main entries for the purposes of the dictionary. Thus, the MPC word for 'chest' is written as *pêtu* /petu/, while the word for 'near' is written as *petu* /pɛtu/. This contrasts with Hancock (2009), who uses an acute accent in the orthographic representation for /e/ (see Table 1).

Word	Representation	Hancock (2009, p. 298)	Baxter and de Silva (2004, p. xii)
chest	orthographic	pétu	*pêtu*
	phonemic	/pɛtu/	/petu/
near	orthographic	pétu	*petu*
	phonemic	/petu/	/pɛtu/

Table 1. A comparison of orthographic and phonemic representation of /e/ and /ɛ/ in MPC

Baxter (1988, p. 26) points out that the use of /e/ and /ɛ/ is said to be not systematic although there is a tendency for "preferred environments" and that clear cut cases of contrast are few and seem to be restricted to three environments: before /t/, /s/ and /z/ (see Table 2).

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

Table 2. /e/ and / ɛ/ before /t/, /s/ and /z/ (Reproduced from Baxter, 1988, p. 26)

Further, similar to /e/ and /ɛ/, the distribution of /o/ and /ɔ/ seems to depend on where it occurs. These phonemes appear to only contrast before /t/, /d/ and /l/, and also in particular "preferred environments" (Baxter (1988, p. 26-27), such as the examples given in Table 3.

[2] Orthographic representations of words are italics, while their phonemic representations are in slash brackets / /. Letters of the alphabet are represented in < >. In quoted material, the symbols are used as represented by the authors.

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

Table 3. /o/ and /ɔ / before /d/, /t/ and /l/ (Reproduced from Baxter, 1988, p. 27)

Baxter (1988) also highlights the connection between the reduced vowel and stress in word final position. In unstressed syllables, <a> tends to be realized as /ə/. This vowel is also produced in rapid speech, such as in the following example *kazamintu* 'wedding' pronounced [kazəˈmintu].

This is similar to Malay where orthographic <a> in word-final position can be realised as /a/ or /ə/. In Malay, however, this is also related to regional differences, with the northern states in Peninsular Malaysia and the two states on the island of Borneo (Sabah and Sarawak) tending to realise it as /a/ while the rest of Malaysia, including Malacca, tend to use /ə/ (Omar, 1977, 1988). For example, the word *suka* 'like' would be pronounced as [sukə] in the central and southern regions of Malaysia.

3. Methods

3.1 Language consultants

As previously mentioned, there are only a small number of fluent MPC speakers at the Portuguese Settlement. For this study, five female MPC language consultants (LCs) were selected based on the following criteria: (i) gender (female speakers), (ii) age (60 and above), (iii) ethnicity defined by them as being Portuguese Eurasian descendants who grew up and still reside in the Portuguese Settlement), (iv) their mother tongue (MPC), (v) language use (they use predominantly MPC to communicate with fellow Portuguese Eurasians in the Settlement). The LCs have an age range of 69-80 years, with a mean of age 73 years at the time of recording. None of the LCs had reported speech or hearing impediments.

None of the LCs had acquired elements of European Portuguese formally or informally. None of the five LCs are employed, or conduct business in the Portuguese Settlement, which means they have less contact with outsiders visiting the community. On the contrary, men being the wage earners of the family tend to work outside the Settlement, and thus, have more external contact. This is one of the reasons for selecting female speakers for this study. The language consultants are coded as LC1 through LC5. All five of them gave written consent to participate in this study. Their details are shown in Table 4.

LC	Age (Years)	Occupation	Languages Spoken*	Education Background
1	75	Housewife	MPC, English, Malay	Primary (English)** Secondary (English)
2	72	Housewife	MPC, English, Malay	None
3	80	Housewife	MPC, English, Malay	Primary (English) Secondary (English)
4	69	Housewife	MPC, English, Malay	Primary (English)
5	71	Housewife	MPC, English, Malay	Primary (English)

* In order of fluency declared by the LCs
** Language in parenthesis indicates medium of instruction

Table 4. MPC language consultants

3.2 Recordings

The recorded data comprised interviews on topics related to life in the Malacca Portuguese Settlement, and was part of the Endangered Languages Archives (Pillai, 2013). The LCs were not given a word list or text to read aloud as there is no standard written form for MPC, and it is generally used in the spoken form rather than used in the written form. Because of these two reasons, earlier attempts by the first author at recording read speech were not successful.

Instead, the LCs were interviewed for language use, their family language policy, their culture, and opinions towards the future of MPC. The interviews were approximately ten minutes each. The interviews in MPC were conducted by the second author, who speaks both European Portuguese and *Kristang*, in the homes of LCs at the Portuguese Settlement. Recordings were carried out using a Marantz PMD661 Solid State Sound Recorder. The recordings were sampled at 44.1 kHz. In order to minimise external noise, a head-worn microphone was positioned close to the speakers' mouths.

3.3 Measurements and analysis

The recordings were orthographically transcribed by a native speaker of MPC. The target vowels were selected from environments without neighbouring nasals, liquids or approximants. These words were then phonetically transcribed and their pronunciation checked with a native speaker of MPC. It is possible that the final result of this study might not present a complete picture of MPC vowels because of these restrictions, but this procedure was adopted in order to reduce co-articulatory influences on the vowels. Thus, the total number of vowels selected for analysis, which was 1083 (see Table 5), does not reflect the total number of vowels produced in the recordings. For example, the vowel /a/ was the most frequently occurring vowel in the selected data, followed by /e/. The vowel /ə/ occurred frequently in open syllable words (CV), and was followed very often by nasals or approximants, or was at the end of phrases with no succeeding

consonants. Such instances were not selected for analysis unless the following word began with a consonant.

MPC Vowels	Number of selected tokens per speaker					
	LC 1	LC 2	LC 3	LC 4	LC 5	TOTAL
/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

Table 5. Number of MPC vowels extracted from the recordings

The selected vowels were subsequently measured using Praat 5.2.04 (Boersma & Weenik, 2010). Visual inspection of the spectrograms of the selected vowels in Praat, and auditory inspection of the recorded speech were combined to determine the location of the vowel. The first (F1) and second formants (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 target 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 & Tillotson, 2001; Ladefoged, 2003). Measurements were done independently by the first two authors, and a Pearson Product-Moment Correlation analysis showed a statistically significant relationship between measurements for F1 and F2 by the first and second authors, $r(2164) = 0.99$, $p < 0.01$. The F1 and F2 values were then converted into a Bark scale (Zwicker & Terhadt, 1980, p. 1524) using the following formula: $Z = 13 \arctan(0.00076F) + 3.5 \arctan(F/7500)$. The average values of the vowels were plotted into F1 vs F2 vowel charts (Hayward 2000), and scatter plots were generated where appropriate.

4. Results and discussion

The average measurements for F1 and F2 as well as their durations Standard Deviations (SD) are presented in Table 6.

Figure 2 shows the vowel quadrilateral for MPC monophthongs. Based on the findings, six monophthong vowels were detected in this study. The placements are close to the descriptions by Baxter (1988). 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.

Vowel	Ave.* Duration and SD** (ms)***	Ave. F1 and SD (Hertz)	Ave. F2 and SD (Hertz)	Ave. F1 (Bark)	Ave. F2 (Bark)
/ɪ/	90.42 (70.13)	451.23 (77.98)	2201.30 (436.42)	4.30 (0.68)	13.54 (1.43)
/e/	129.12 (0.09)	507.08 (72.21)	2251.68 (389.81)	4.79 (0.61)	13.72 (1.33)
/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)
/u/	78.08 (49.35)	460.55 (61.70)	1553.10 (319.25)	4.39 (0.54)	11.28 (1.42)
/ɔ/	103.34 (65.64)	580.37 (85.45)	1178.28 (252.04)	5.40 (0.71)	9.46 (1.35)
Average		545.39 (84.79)	1750.98 (331.75)	5.09 (0.70)	11.92 (1.33)

* Ave. = Average
** SD = Standard Deviation (in parenthesis)
*** ms = millisecond

Table 6. Average F1 and F2 measurements of MPC monophthongs

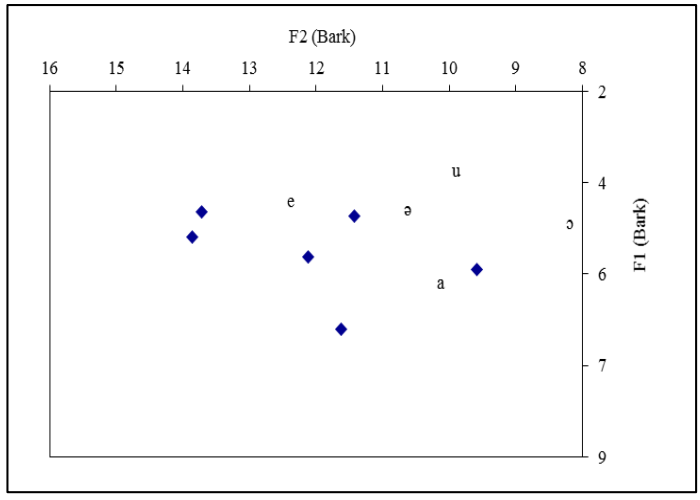

Figure 2. Vowel Chart for MPC

4.1 MPC /i/

The vowel /i/ occurred in words such as *fikah* ‘stay’, *akih* ‘here’, *kukis* ‘cookies, *jinjibri* ‘ginger’ *disnovi* ‘nineteen’. As shown in Figure 3, the distribution for /i/ is scattered in the vowel space, suggesting considerable variation in the way that the vowel was produced by each LC and across the five LCs.

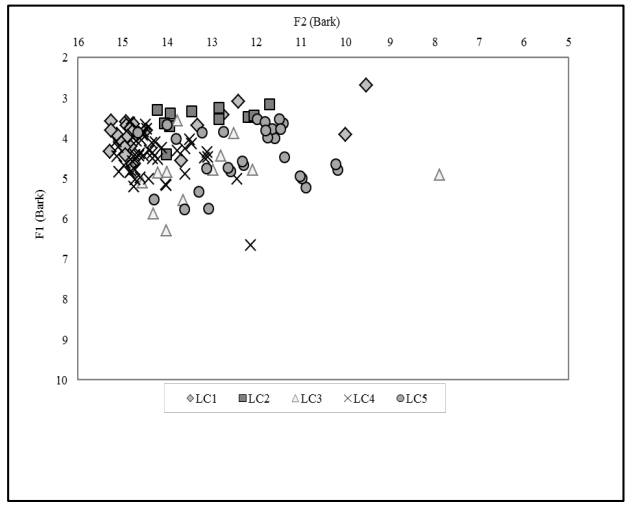

Figure 3. Scatter plot for MPC /i/

4.2 MPC /e/

The vowel /e/ occurred in words such as *fazeh* ‘to do’, *mbes* ‘a little’ and *sabeh* ‘to know’. As can be seen in Figure 4, there is considerable variation in the way that this vowel was realised. For example, LC1 produced /e/ at a high front position, while LC4’s /e/ were more scattered at the high front position. LC5’s /e/, on the other hand, was produced more back than those produced by the other LCs. There also appeared to be no distinct variation between the realisation of /e/ and /ɛ/ for example in words like *bebeh* ‘to drink’ (bɛˈbe) or *des* ‘ten’ (/dɛs).

Baxter (1988, p. 26) points out that there is a contrast between /e/ and /ɛ/ before /t/, /s/ and /z/. Thus, a comparison of the F1 and F2 values for vowels located before /t/, /s/, and /z/ was carried out. However, no particular pattern was observed in the data to this effect. A one-way analysis of variance (ANOVA) also showed that there were no significant differences between the F1 as well as the F2 of /e/ in the three environments: $F(2, 40) = 4.01$, $p = 0.0259$, $F(2, 40) = 0.79$, $p = 0.4608$.

Baxter (1988) also suggests that the realisation of either /e/ - /ɛ/ may be due to vowel harmony. 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. However, no difference in vowel height was found due to the influence of the vowel in the following syllable.

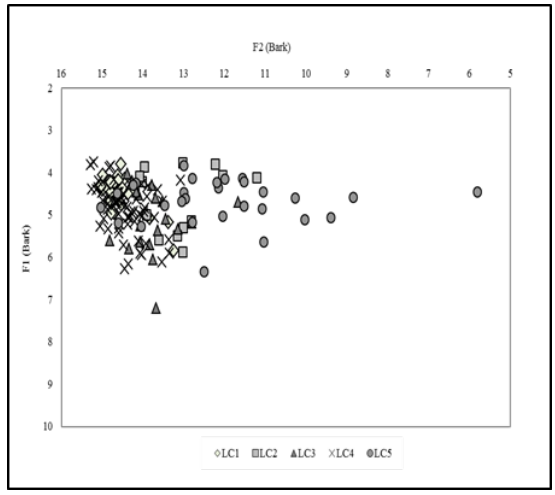

Figure 4. Scatter plot for MPC /e/

4.3 MPC /ə/

The vowel /ə/ occurred mainly in unstressed syllables, such as in *kaz<u>a</u>* 'married', *b<u>a</u>t<u>a</u>ta* 'potato', and *peskad<u>o</u>r* 'fishermen' (stressed syllables are underlined). From Figure 5 it can be seen that the vowels produced by LC4 and LC5 are scattered across the front and back vowel space, while LC1 produced more fronted /ə/ vowels.

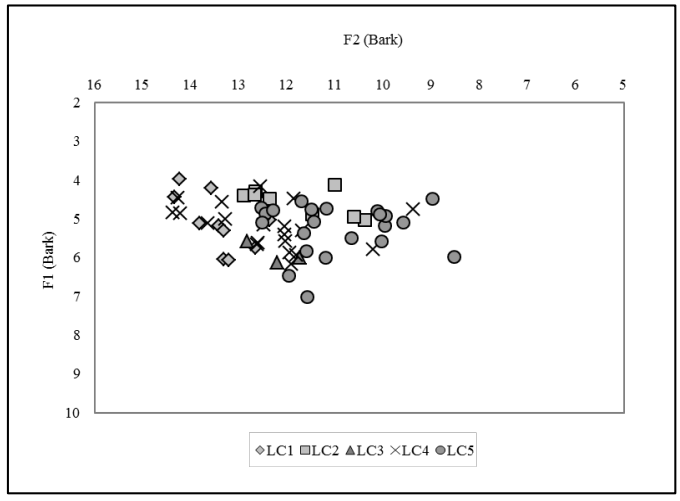

Figure 5. Scatter plot for MPC /ə/

A one-way ANOVA of three LCs was performed, and no significant differences were found for F1, $F(2, 49) = 0.18$, $p = 0.8358$. 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 for F2, $F(2, 49) = 19.95$, $p < .0001$. Tukey post-hoc comparisons of the three LCs indicated that F2 was 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 suggests that the three LCs generally produced the vowel /ə/ similarly.

4.4 MPC /u/

The vowel /u/ was found in words such as *tudu* 'all', *kukus* 'steam', *Portugis* 'Portuguese', *butika* 'shop', and *fubeh* 'boil'. From Figure 6 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.

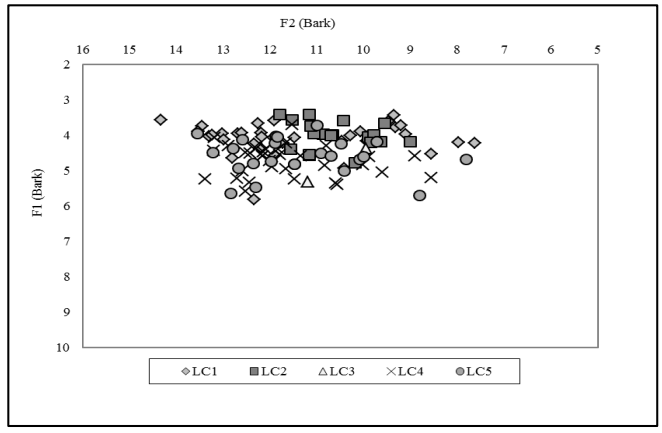

Figure 6. Scatter plot for MPC /u/

A one-way ANOVA showed that there were significant differences in the F1 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 F1 was 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 suggests that there was considerable difference in vowel height for /u/.

A one-way ANOVA also showed that there were significant differences between the F2 of the four LCs, $F(3, 108) = 2.69$, $p = 0.049$. A Tukey post-hoc comparisons of the four LCs show that F2 was significantly different for LC2 (M = 1377Hz, SD = 159.4Hz) and LC4 (M = 1624.2Hz, SD = 273.2Hz). This dispersion is visible in Figure 6.

4.5 MPC /ɔ/

The vowel /o/ was found in words such as *gostah* ‘like’, *aboh* ‘grandparent’, *podi* ‘can’, *bos* ‘your’, and *mpoku* ‘a little’. Figure 7 shows the distribution for /o/. There was no clear distinction made between /o/ and /ɔ/ by the speakers in this study in words like *angkoza* ‘things’, *kofi* ‘coffee’ and *repostah* ‘response’ which are generally realised with a more open vowel (/ɔ/).

The vowels produced by them are scattered in the vowel space, suggesting considerable variation in the way that it was produced by the LCs. However, a one-way ANOVA showed that there were no significant differences between the F1 for this vowel among the four LCs (LC1 was removed for analysis there were less than ten words containing /o/), $F(3, 96) = 2.65$, $p = 0.532$. As F1 value correlates with vowel height, this suggests that all the LCs produced /o/ with similar vowel height. In contrast, a one-way ANOVA showed there were significant differences between the average F2 of the four LCs, $F(3, 96) = 5.67$, $p < .01$. Tukey post-hoc comparisons of the four LCs show that the F2s 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 7, where it can be seen that the vowel /o/ produced by LC5 was produced further front in the vowel space compared to those of the other LCs.

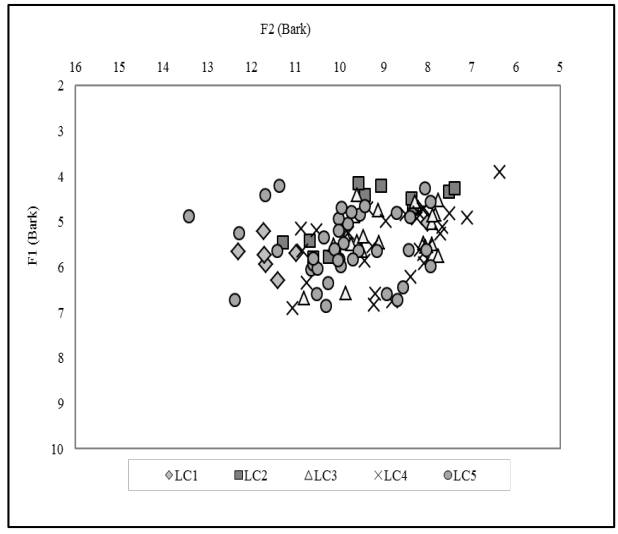

Figure 7. Scatter plot for MPC /ɔ/

As mentioned previously, Baxter (1988) posits that there may be an /o/ and /ɔ/ contrast in some words before /t/, /d/ and /l/. No instances of /o/ or /ɔ/ preceding /l/ were found in the selected data. Further, as discussed earlier in this paper, Baxter (1988) also comments that the distribution of the /o/ and /ɔ/ displays a tendency towards vowel harmony effect. 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/). Figure 8 shows that /ɔ/ tends

to be produced higher when it is followed by high vowels while the reverse 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 pattern.

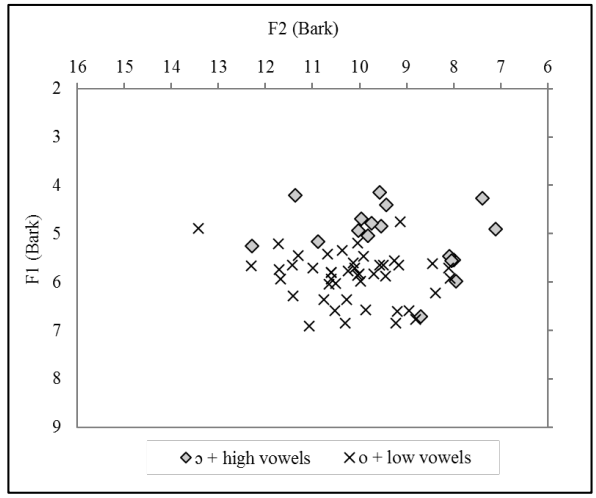

Figure 8. Scatter plot of /ɔ/ followed by high and low vowels

An independent t-test showed a significant difference for the F1 values of the vowel followed by high vowels and low vowels in the following syllable: ($t(60)= 5.2$, $p < .0001$, two-tailed). As F1 correlates to vowel height, the vowel height when this vowel occurs before high and low vowels appear to be significantly different. However, no significant difference was found for the mean F2 values of /o/ preceding high vowels and low vowels: ($t(60)= 2.33$, $p = 0.0232$, two-tailed).

4.6 MPC /a/

The MPC monophthong /a/ occurred in words such as *papiah* 'speak', *satenta* 'seventy', *fazeh* 'do', *fikah* 'stay', *sabeh* 'know' and *ngka* 'do not'. Like the other vowels, Figure 9 shows that the distribution for /a/ is scattered in the vowel space suggesting considerable variation in the way that it is produced. This is consistent with a one-way ANOVA where a significant difference in the F1 of this vowel among the five LCs, $F(4, 489) = 15.2$, $p < .0001$. Tukey post-hoc comparisons of the five LCs show that F1 was significantly different between the speakers except 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 in how the five LCs produced /a/ in terms of vowel height. Significant differences between the F2 of this vowel for the five LC were also found, $F(4, 489) = 12.76$, $p < .0001$. Tukey post-hoc comparisons of the F2 of the

five LCs show it was 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 what is displayed in Figure 9, the vowels were produced differently by each LC in terms of vowel fronting.

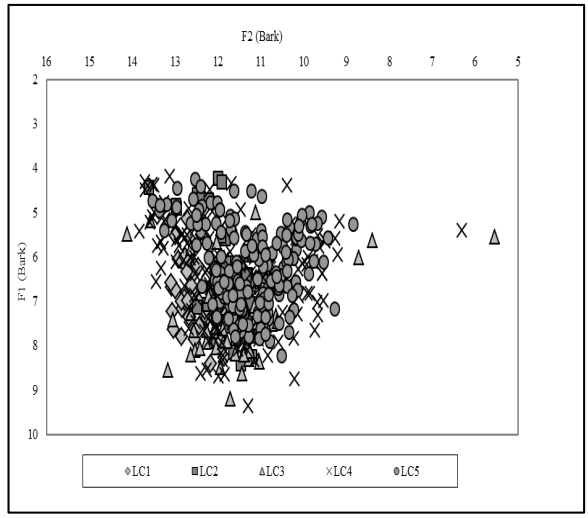

Figure 9. Scatter plot of MPC /a/

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/", and in order to test this out a scatter plot with the four vowels was generated. Figure 10 indicates that the four vowels have a tendency to overlap with each other. However, there were significant differences between the F1 of the four vowels, $F(3, 522) = 70.6$, $p < .0001$. Tukey post-hoc comparisons of the four vowels show that F1 was 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 of the four vowels: $F(3, 522) = 259.3$, $p < .0001$). Tukey post-hoc comparisons of the four vowels show that F1 was 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/.

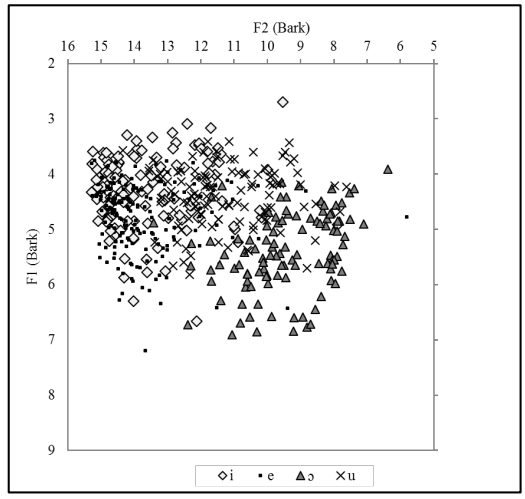

Figure 10. Scatter plot of MPC /i/, /e/, /o/, /u/

To further examine the pairs of /i/ and /e/ and /o/ and /u/, further scatter plots (see Figure 11 and Figure 12) were generated isolating these pairs. An independent samples t-test indicated a significant difference for the mean F1 values of /i/ and /e/: ($t(303) = 6.41$, $p < .0001$, two-tailed). 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 (303) = 1.05, $p = 0.2946$, 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 11.

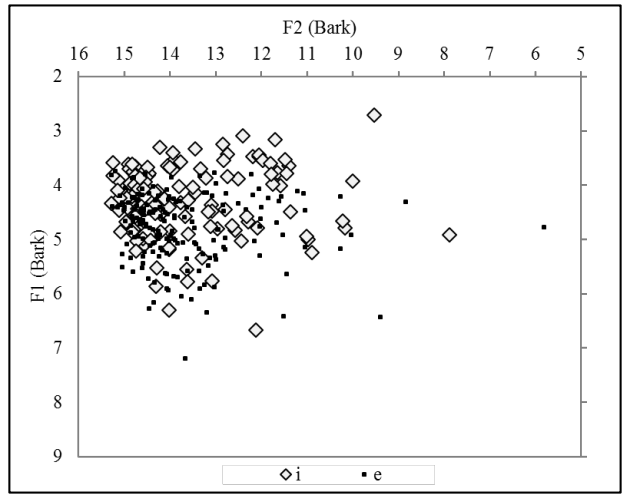

Figure 11. Scatter plot of MPC /i/ and /e/

For the vowel pair /ɔ/ and /u/, significant differences were found for the mean F1 values of these vowels: ($t(219) = 11.98$, $p < .0001$, two-tailed, independent samples), thus

suggesting that /ɔ/ and /u/ 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/: ($t(219) = 9.68$, $p < .0001$, two-tailed, independent samples). This contrast can be seen in Figure 12. Thus, it does not appear as if there is free variation for this vowel pair.

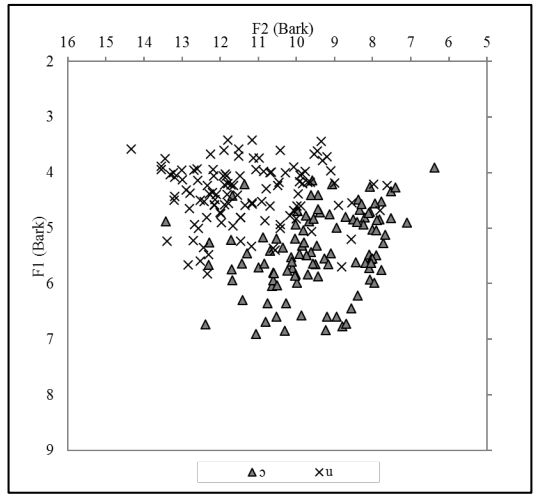

Figure 12. Scatter plot of /ɔ/ and /u/

5. Summary and conclusion

Six MPC monophthong vowels emerged from the data: /i/, /e/, /ə/, /a/, /o/ 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, and there was considerable overlap between these two vowels which may indicate that they are being used interchangeably by some MPC LCs. The vowel /u/ was relatively more fronted based on our data compared to previous descriptions, which may also be an effect of the speaking context.

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).

Because the target vowels were selected from environments without neighbouring nasals, liquids or approximants, it is likely that the use of the vowels /ɛ/ and /ɔ/ did not emerge in this study. The few words where the use of /ɛ/ and /ɔ/ would have been expected were not clearly distinguishable from /e/ and /o/ respectively. We were also not able to verify a /e/-/ɛ/ and /o/-/ɔ/ distinction preceding /t/, /s/ and /z/ from the selected data (see Baxter 1988). However, there is some indication that for /o/, there may be a height distinction before /t/ and /d/ but this warrants further investigation. There was also some

indication that /o/ 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. The findings from this study highlight the degree of variability in the way that the monophthongs are being pronounced, where there is considerable within and among speaker variability in vowel quality.

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. 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 based on the data selection criteria used in this study. As MPC is an oral language, the use of read text was not deemed suitable for data elicitation. These limitations were taken into consideration when interpreting the findings.

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