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Representation of English Front Vowels by Malay-English Bilinguals

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ABSTRACT

This paper presents the results of a study conducted to investigate the representation of English vowels among Malay-English bilingual speakers. The study focused on five front vowels of English. There is a tense-lax contrast in high- and mid-vowels in English (Davenport and Hannahs, 2005; Fromkin, Rodman and Hyams, 2003), but this contrast does not exist anywhere in Malay (Nik Safiah *et al*., 2008). Thus, a forced choice identification task is constructed with PRAAT (Boersma and Weenick, 2009). Stimuli for the experiment were synthesized using the AT&T text-to-speech demo programme available from AT&T Labs. The values of the first and second formants of the vowels were checked to make sure that they were within the range given in the literature. Fifty-two Malay-English bilingual undergraduates participated in this study. The results showed that Malay-English bilinguals have only three categories of contrast for the front vowels. These results show that the vowel representation of the second language in Malay-English bilinguals is similar to the representation of vowels in the first language.

Keywords: Bilingual speech perception, Malay-English bilinguals, vowel representation

INTRODUCTION

Both anecdotal and instrumental accounts of variation in English pronunciation among Malaysian speakers are available in the literature (e.g. Zuraidah, Pillai and Tang, 2008; Pillai, 2008; Baskaran, 2005; Platt and Weber, 1980; Hart, 1969). Experienced English teachers may also be able to provide a list of commonly mispronounced words by Malaysian ESL learners. For example, Malaysians often use context to disambiguate between words like *pitch* and *peach*, and words like *pen* and *pan*. However, the cause(s) of such variation in pronunciation and the link with perception of vowels have not received much attention.

Baskaran (2005), in her discussion about the phonological properties of Malaysian English, provides a descriptive account of such variations but no discussion was made on the perception of English vowels by Malaysian English speakers. Zuraidah, Pillai and Tang (2008) showed that Malaysian English vowels occupy a more compact vowel space compared to the British or American English varieties. They provided the mapping of 11 vowel categories, 4 of which were front vowels (/i/, /ɪ/, /ɛ/ and /æ/), focussing on the monophthongs.[1] However, the study focussed only on speech production and not on the perception of English vowels by Malaysian speakers of English. This is the gap in the literature, which is partially filled in the current study. This study sets out to ascertain the mental representation of English front vowels among Malay-English bilingual speakers by looking at their perception of these vowels.

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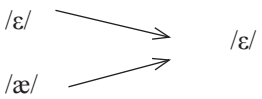
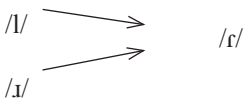
Studies on second language (L2) speech perception have identified three patterns in the perception of non-native contrasts: single-category, two-category and multiple-category assimilation (e.g. Best, 1995; Flege, 1995; Escudero and Boersma, 2002). The first two patterns, namely single-category and two-category assimilation, are well-documented in the Perceptual Assimilation Model (Best, 1995) and the Speech Learning Model (Flege, 1995). The basic claim of these two models is that the learners' first language (L1) influences the perception and the development of categorical contrasts in the second language. When the target L2 language has more categorical distinctions than what is available in the L1, single-category assimilation occurs, and this is probably as a result of poor perceptual differentiation of categorical contrasts in the L2. In such cases, the initial state of L2 mapping is a copy of the L1 perceptual space. Evidence of category assimilation is reported in the literature for language learners with various L1s. For example, Escudero and Boersma (2002) provide the following examples:

(1) L2 English L1 Dutch



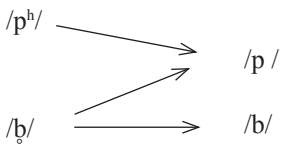
L2 English L1 Japanese



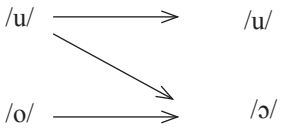
L1-Dutch ESL learners merge English mid- and low-front vowels, /ɛ/ and /æ/, respectively to a single category, /ɛ/, because the categorical distinction that is available in English does not exist in Dutch. Similarly, Japanese learners merge the categories for the lateral and the central approximant in English to the Japanese flap. These examples of single-category assimilation are considered as the most problematic for L2 learning with implications not only in lexicalization but also for attainment of native-like speech production.

The second pattern of non-native perception involves the two-category assimilation, where a binary contrast in the L2 is mapped to a binary contrast found in the L1. Best (1995) and Flege (1995) consider this pattern of perception as less problematic compared to the single-category assimilation cases because the categorical contrast in the L2 is preserved to a certain extent. The following are examples of the two-category assimilation provided in Escudero and Boersma (2002).

(2) L2 English L1 Dutch

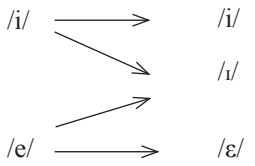


L2 Spanish L1 Dutch

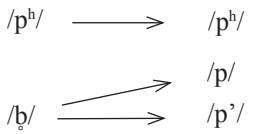


Escudero and Boersma (2002) argued that multiple-category assimilation could also be problematic for acquisition of L2 contrasts. Such cases of assimilation occur when there are fewer categories of contrast in the L2 compared to that found in the L1. For example, as shown in the following examples taken from Escudero and Boersma (2002), there are more categories of vowels in Dutch compared to those found in Spanish, and more categories of stops are found in Korean compared to those that in English. In such situations, L2 learners also start with an initial mapping similar to that which is available in the L1, but as they advanced, Escudero and Boersma (2002) found that the L2 learners were able to reconstruct their perceptual boundaries to eliminate the extraneous category in their representation for the L2.

(3) L2 Spanish L1 Dutch



L2 English L1 Korean



In the context of the languages that were investigated in this study, English and Malay, instances of single- and two-category assimilation are expected since the number of vowel categories found in English is greater compared to those found in Malay.

A Comparison of the Vowel Inventories in Malay and English

Figs. 1 and *2* summarise the differences in the vowel inventories of Malay and English. There are far more vowel categories in the English speech system compared to Malay. In particular, there are five front vowels in English compared to only three in Malay. Moreover, the tense-lax contrast that exists in English is absent in Malay. Vowel length, i.e. a phonetic character of tense vowels (Fromkin, Rodman and Hyams, 2003), is also not distinctive in Malay. In addition, the mid-front vowels, [e] and [ɛ], are allophonic variants of the phoneme /e/ in Malay (Nik Safiah *et al*., 2008).

	Front	Central	Back
High	i		u
Mid	e	ə	o
Low	a		

Fig. 1: Vowel phonemes in Malay (Nik Safiah et al., 2008)[2]

	Front	Central	Back
High	i ɪ		ʊ u
Mid	e ɛ	ɜ: ə	ɔ o
Low	æ	ʌ	ɑ: ɒ

Fig. 2: Vowel phonemes in English (adapted from Davenport and Hannahs, 2005)[3]

MATERIALS AND METHODS

Instrument

A forced-choice identification experiment was constructed using PRAAT (Boersma and Weenick, 2009). The stimulus items were *beat*, *bit*, *bait*, *bet*, and *bat*. The stimulus items were generated using the AT&T text-to-speech demo programme using four speakers: two male and two female speakers, 2 American and 2 British speech models to represent the two English varieties. These stimulus items were pilot-tested with ten Malay-English bilingual speakers. The one-sample Kolmogorov-smirnov test showed that the normality assumption is met with the data in the pilot study, and a two-tailed paired sample *t*-test conducted on the results of the pilot test found no significant difference in the response to the American and British stimulus items ($t(9) = -1.62$, $p > 0.05$). Based on these results, it was decided that the identification experiment could and should include both the American and British stimulus items because Malaysian speakers are exposed to both varieties.[4] The values of the first three formants of the vowels were also checked to make sure that they were within the range of the relevant vowels in the literature. Table 1 presents the vowel formant values for the items generated and the respective formant values for the vowels in American English.

The experiment was also pilot-tested with one American English native speaker to check the suitability of the stimulus items used. The native speaker performed appropriately at the

TABLE 1
Vowel formant values of the generated stimulus items[5]

Vowels	American English (Davenport and Hannahs, 2005)			Mean formant values for generated samples		
	F1	F2	F3	F1	F2	F3
/i/	280	2320	2870	297	2427	2935
/I/	440	2000	2730	453	1807	2551
/e/	NA	NA	NA	482	2102	2749
/ɛ/	580	1740	2510	620	1741	2648
/Θ/	690	1440	2430	777	1541	2376

level of 100% for four of the vowel categories. However, a lower percentage was obtained for *bet* (87.5%) because the participant made two errors by clicking on the wrong word in trying to complete the task quickly. The native participant informed the researcher of the errors made. Since the performance for the other categories were perfect, the same experiment was used with the Malay-English bilinguals.

Participants

The participants involved in the study were Malay-English bilingual undergraduates from a public university in Malaysia. A total of 52 students volunteered for the study. Volunteers were elicited from two groups of students which had been identified for the study. The first group were students taking English language related majors but had not taken a course in English phonetics and phonology. They were selected to represent the advanced group in terms of English language proficiency. The participants were majoring in English Language (22), English Literature (5), and TESL or Teaching of English as a second language (7). Eleven of the participants had obtained a Band 3, twenty had a Band 4, while three had a Band 5 in the Malaysian University English Test (MUET). The second group of the participants were students who had been selected from those enrolled in the first level of the compulsory English language proficiency class at the university to represent the group with a lower level of English language proficiency. Sixteen of the students had obtained a MUET score of Band 2, while two others obtained a Band 3. These students were of Economics (8), Mathematics (2), Engineering (1), Physics (3), Microbiology (1), and Arabic (3) majors. None of the participants in both groups had had any training in English phonetics when they participated in the experiment.

Research Procedure

The data collection session was conducted in a language laboratory. Each student was assigned a seat at the language laboratory. They were asked to fill in a background questionnaire, which elicited information about their mother tongue, the dominant language used, English proficiency courses taken at the university, and their MUET scores. The participants were then briefed on the procedure involved in the experiment. They were told that they would hear a word over the headphone and that they had to indicate the word they had heard by clicking on it on the computer screen. They were told that the word would not be repeated and that they had to provide an absolute certainty judgement of their answer by choosing from a scale of 1

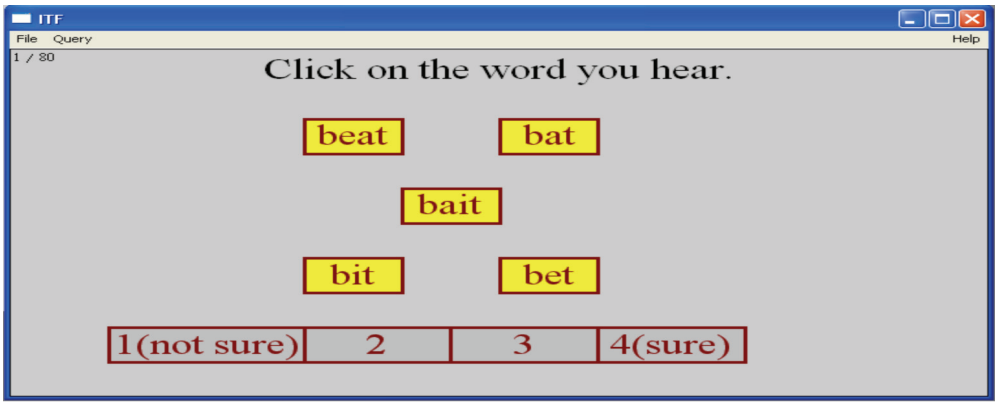


Fig. 3: Screenshot of the experiment interface

to 4 (1 for not sure, and 4 for sure). Once the certainty judgement was made, the following word was presented. *Fig. 3* shows the interface for the forced-choice identification experiment.

The stimuli were presented in a random order using PRAAT, with an inter-stimulus interval of 500ms. A total of 20 different stimulus items was presented with four repetitions of each item resulting in a total of 80 trials, that were presented in four blocks of 20 items each.

Data Analysis

Data from the experiments were extracted from PRAAT, coded, and analysed using SPSS. Correct identification was assigned a score of one point, while incorrect answers were given a score of zero. The score for each vowel category was tabulated. The percentage contributed by the distractors for each vowel category was also tabulated. The reported MUET scores were used to group the students into two groups, according to their level of proficiency in English. The one-sample Kolmogorov-Smirnov test of normality was used to test for normality of distribution in the data. The results show that normality could not be assumed for all the categories of vowels; hence, the Mann-Whitney *U* test was used to compare the performance of the students in the two groups for each vowel category.

RESULTS AND DISCUSSION

The results shown in *Fig. 4* indicate that the Malay-English bilinguals performed relatively well in the identification of two vowel categories, namely the mid-front tense vowel /e/ in *bait* [6] and the low-front vowel /æ/ in *bat*.

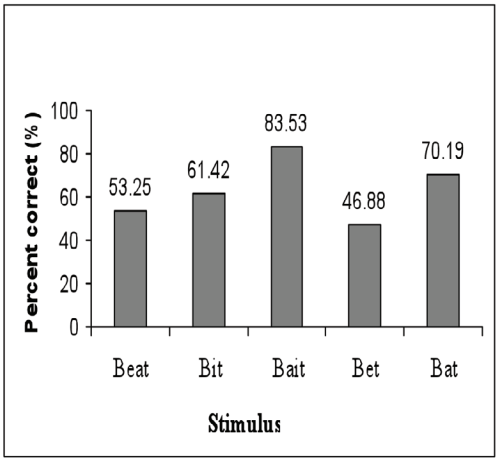


Fig. 4: Identification of the front vowels

An interesting pattern was found when the distractors for each stimulus item were analysed. The highest percentage of distraction for *beat* was *bit* and vice versa, as shown in *Figs. 5* and *6*. The results show that the Malay-English bilinguals have a difficult time discriminating the tense and lax high-front vowels in English.

Bit is also an overwhelmingly strong distractor when *beat* is presented. The results suggest a possible assimilation of these two categories of English vowels in the mental representation of the Malay-English bilinguals. It is important to note that the Malay language does not have a tense-lax distinction or a length distinction for its vowels. While the English high-front tense vowel, which is usually realised longer in length compared to its lax counterpart, provides two possible acoustic cues, both of these cues are inaccessible to Malay-English bilinguals. Although the percentage for the correct identification of *beat* is slightly lower than that obtained for *bit* when *bit* was presented, the students were also confused with other words, as shown in *Fig. 6*.

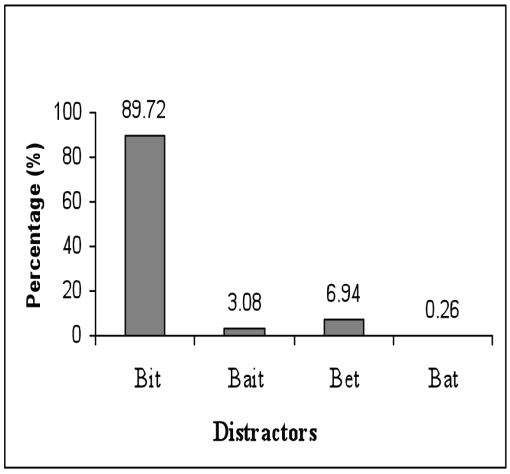


Fig. 5: Proportion of distraction for beat

Fig. 6: Proportion of distraction for bit

Meanwhile, there was less confusion when *beat* was presented. Taken together, these results suggest that the vowel representation, that is operative in Malay-English bilinguals, is more likely to be closer to the high-front tense vowel. Hence, single-category assimilation in the form summarized in (4) can be concluded where L2 learners map L2 sounds onto its similar L1 counterpart.

(4)

English	Malay-English Bilinguals / Malay
/i/	/i/
/ɪ/	

A similar pattern of assimilation was also observed for *bet* and *bat*, as shown in *Figs. 7* and *8* below. The percentage of correct identification for *bat* is relatively higher compared to that for *bet*, while the proportion of distraction attributed to *bat* when *bet* was presented is also exceedingly high (81.9%). Thus, it can be concluded that the vowel representation that is operative in the Malay-English bilingual speaker is more likely to be the low-front vowel /æ/.

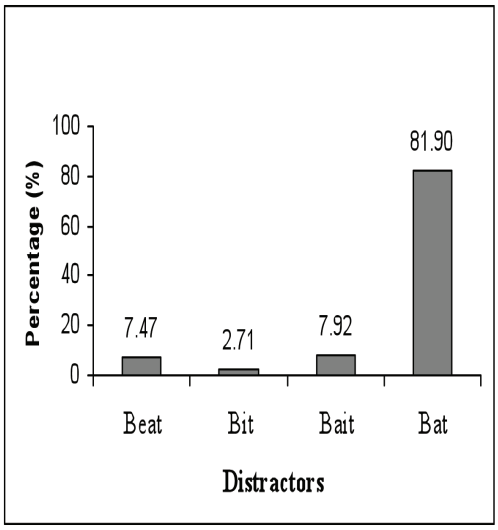


Fig. 7: Proportion of distraction for bet

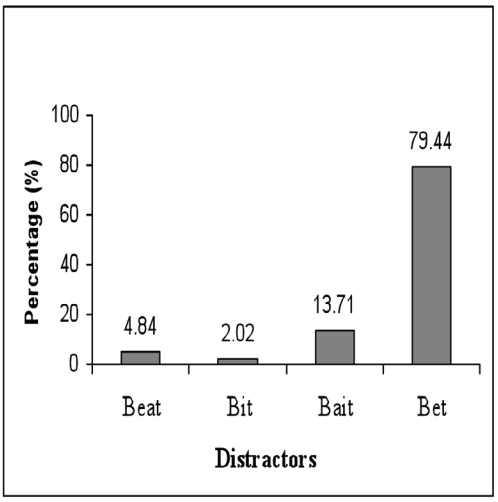
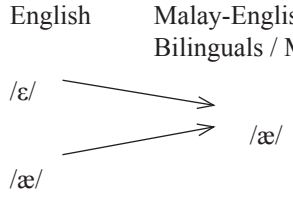


Fig. 8: Proportion of distraction for bat

The Malay language does not have a mid-front lax vowel. Taken together with the results of the identification task, the findings suggest that the vowel representation that is operative in the Malay-English bilingual is more likely to be the low-front vowel. Hence, the category assimilation in the form summarized in (5) can be concluded.

(5)



Unlike the earlier example (in 4) which could be attributed to the lack of tense-lax or length distinction in Malay, however, the assimilation of categories described in (5) presents an additional puzzle in understanding L1-effects on L2 vowel representation. Since /e/ and /ɛ/ are the tense-lax pairs in English, the assimilation of these two vowel categories is expected if the single-category assimilation is motivated by an absence of the tense-lax contrast in the L1. Furthermore, since the mid-front vowels are allophonic variants in Malay, they should be more susceptible to single-category assimilation. The fact that the results show otherwise suggests that other factors may influence the process of single-category assimilation.

The mid-front tense vowel, /e/, is often phonetically realized as a diphthong. It could be the case that the phonetic cues of a diphthong are more salient and perceptible. This could also be the reason why the mid-front lax vowel undergoes category assimilation with the low-front lax vowel instead because both the categories are phonetically realized as monophthongs and may be considered closer in terms of their perceptual distance (Johnson, 2003).

The highest percentage of correct identification was observed for the mid-front tense vowel /e/ in *bait*. This was most likely attributed to direct mapping onto a similar category found in Malay, or to the salience of this particular vowel category, which is realized phonetically as a diphthong in many varieties of English. The analysis from the incorrect answers shown in *Fig. 9* reveals that *bait* was sometimes confused with *bet*. This confusion may be attributed to the fact that [e] and [ɛ] are allophonic variants in Malay. For example, the word *gelek* 'to roll over' may be pronounced as [gɛlɛk] or [gelek] in Malay. However, it should be noted that the percentage of error was rather small, i.e. at about 4.21%, and may be regarded as negligible.

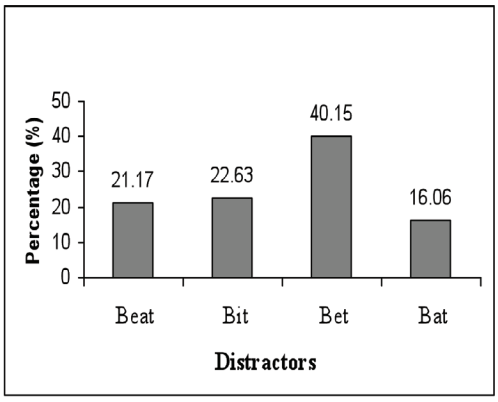
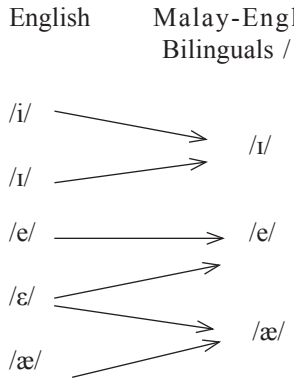


Fig. 9: Proportion of distraction for bait

In sum, it can be concluded that Malay-English bilinguals only have 3 distinctive categories of front vowels since there are two instances of single-category assimilations. The representation of English front vowels in Malay-English bilinguals can therefore be summarised in (6).

(6)



The English language proficiency of the subjects, as indicated by the results obtained in the Malaysian University English Test (MUET), ranges from Bands 2 through 5. Students with MUET band 2 were assigned to the weak group, while students with MUET bands 3 and 4 were assigned to the advanced group. Since there were only three subjects who had a MUET band 5 score, these subjects were removed from the statistical analysis.[7] *Fig. 10* shows the distribution of the scores for the two groups of students.

The one-sample Kolmogorov-Smirnov showed that normality could not be assumed for all categories of vowels. The non-parametric Mann-Whitney *U* analyses revealed that the performance of the weak or less proficient bilinguals (n = 16) was significantly different from the performance of the advanced bilinguals for only the mid-front tense vowel in *bait* (n= 33), $z = -2.632$, $p < 0.05$. The performance of the students in the identification experiment was not statistically significant between the weak and advanced bilinguals for all the other categories of vowels ($p > 0.05$), as shown in Table 2.

The analyses also show that the participants' level of English proficiency had little influence on their performance, particularly for the vowels which were included in the single-category assimilation. The occurrence of the single-category assimilations of the English vowels in the mental representation of Malay-English bilinguals could possibly be generalized to the population of these speakers, regardless of their level of proficiency in English.

CONCLUSIONS

This study shows that the Malay-English bilinguals have only three categories of front vowels. The results obtained from this study are consistent with the literature on L2 speech perception and production (e.g. Flege, 1987; Best *et al*., 2001; Flege *et al*., 2003; MacKay *et al*., 2001), where L2 vowels are mapped onto a representation similar to that available in their L1. In this study, the Malay-English bilinguals were found to have assimilated the categories of vowels that were not found in the vowel representation in Malay.

The findings of this study are also, to a great extent, consistent with the findings of the speech production studies conducted on the vowel space occupied by Malaysian English. Zuraidah, Pillai and Tang (2008) claim that there are 4 categories of the front vowels in Malaysian English: two high-front vowels, one mid-front and one low-front vowel, respectively (/i/, /ɪ/, /ɛ/ and /æ/). The mid-front tense vowel /e/ was not considered, possibly because it was categorised as a diphthong. With this vowel category removed, the identification experiment shows that Malay-English bilinguals are able to distinguish only two categories of the front vowels, instead of four.

Further studies should be conducted to include other bilingual groups in Malaysia to see if some subgroups could perceive the tense-lax distinction in English high-front and -back vowels, and to ascertain the number of categorical distinctions maintained by Malaysian English speakers. Further work should also be done to include the central and back vowels to provide a more comprehensive coverage of the Malay-English bilinguals' perceptiveness of English vowel categories.

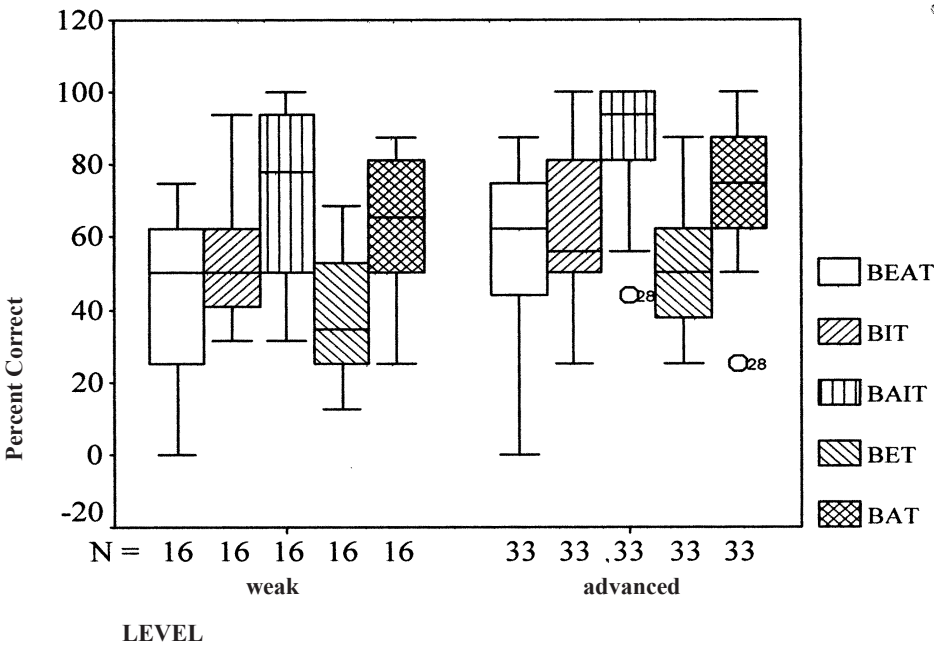


Fig. 10: Performance in vowel identification by proficiency level

TABLE 2
Proficiency level and identification of English front vowels

	Level	N	Mean rank	Sum of ranks	Mann-Whitney U	z	p
/i/	weak	16	19.69	315.00	179.000	-1.823	.068
	advanced	33	27.58	910.00			
/ɪ/	weak	16	20.34	325.50	189.500	-1.598	.110
	advanced	33	27.26	899.50			
/e/	weak	16	17.47	279.50	143.500	-2.632	.008*
	advanced	33	28.65	945.50			
/ɛ/	weak	16	19.38	310.00	174.000	-1.934	.053
	advanced	33	27.73	915.00			
/æ/	weak	16	20.06	321.00	185.000	-1.696	.090
	advanced	33	27.39	904.00			

*significant at 0.05

Nonetheless, the current study has established a link between the perceptual ability of Malay-English bilinguals, with the variation in the pronunciation of Malaysian speakers of English that is recorded in the literature (e.g. Baskaran, 2005; Zuraidah, Pillai and Tang, 2008; Pillai, 2008). The results suggest that the variations or 'pronunciation errors' among Malaysians may in fact not be 'errors', since bilingual speakers could not perceive a categorical difference in the first place. Therefore, any effort directed towards improving or correcting the pronunciation of Malay-English bilingual speakers, if necessary, will inevitably involve improving the speakers' ability to perceive categorical contrasts in the target language that are absent in their first language.

ENDNOTES

[1]The mid-front tense vowel /e/ is often realized as the diphthong [eɪ] in some British and American varieties of English. According to Fromkin, Rodman and Hyams (2003), some English speakers diphthongise all front and back tense vowels, while others, particularly speakers in Ireland, produce them as monophthongs. With these variations in mind, we followed Fromkin, Rodman and Hyams (2003) in using /e/ to refer to the vowel in *bait*.

[2]We are aware of Nor Hashimah's (1998) assertion that the low vowel in Malay may be more accurately described as the unrounded low back vowel, /ɑ/. However, for the purpose of this study, the authors used the description provided in Nik Safiah *et al*. (2008).

[3]As indicated in footnote 1, the midfront tense vowel /e/ may be realised as the dipthong [eɪ], and for this reason, it is often not included in the vowel chart which focuses mainly on monophthongs. However, the authors included it in this study to enable comparison with the vowel categories in Malay. Note that the vowel phonemes from both the American and British varieties are also included in the same vowel chart. See Davenport and Hannahs (2005) for details on the differences in the vowel inventories of various English varieties.

[4]The AT&T demo programme does not specify which British or American varieties are modelled. For this reason, the authors also refer to these two varieties in a general manner.

[5]/e/ is realised as a dipthong in some varieties of English. Therefore, the formant values are characterised by directional movements. Since the formant values of this category are not reported in the literature, only the formant values for the generated vowel are provided in this paper.

[6]The inclusion of *bait* as a stimulus item in the identification experiment could also be justified in its role to help identify non-serious participants, although none was identified in this study. The results show that the participants have little problem in identifying *bait*. Therefore, serious participants should perform above chance level when *bait* is presented; while no difference is expected for this vowel and the other vowels for non-serious participoants.

[7]Similar results were obtained even when these three subjects were included in the advance group.

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