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A Comparison of English, Acehnese, and Indonesian Monophthongs

Tanzir Masykar¹

Stefanie Pillai^{*2}

Roshidah Hassan³

¹Akademi Komunitas Negeri Aceh Barat, Meureubo, West Aceh Regency, Aceh 23681, INDONESIA

²Department of English Language, Faculty of Languages & Linguistics, Universiti Malaya, Kuala Lumpur 50603, MALAYSIA

³Department of Asian and European Languages, Faculty of Languages & Linguistics, Universiti Malaya, Kuala Lumpur 50603, MALAYSIA

Abstract

Foreign language learners tend to approximate the quality of non-native vowels to their existing vowel systems. This phenomenon becomes more complicated in learners who already have more than one vowel system in their linguistic repertoire. When learning English, Acehnese-Indonesian speakers are likely to already have two other vowel systems, Acehnese and Indonesian. Thus, the quality of English monophthongs produced by these speakers may resemble the equivalent of Acehnese and Indonesian monophthongs. This study compares the quality of English monophthongs to equivalent Acehnese and Indonesian monophthongs produced by Acehnese-Indonesian speakers. A total of 29 students from a Modern Islamic Boarding School in Aceh participated in this study. The students were recorded producing nine English, 11 Acehnese, and seven Indonesian monophthongs embedded in target words produced in a carrier sentence. The study found that the nine English monophthongs were produced at an approximate quality to either Acehnese and/or Indonesian monophthongs. In some cases, the English vowel was produced similarly to both the equivalent vowels in Acehnese and Indonesian. In other cases, the English vowel was produced more similarly to either Acehnese or Indonesian. The

* Corresponding author, email: stefanie@um.edu.my

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findings of this study provide insights into how Acehnese-Indonesian learners filter English vowels through their existing L1 and L2 sounds and allow for a better understanding of this phenomenon via existing conceptual models. The findings also point to the often-ignored influence of other languages in a speaker's repertoire on the learning and production of a new language.

Keywords: Acehnese, English, Indonesian, monophthongs, vowel quality.

1. INTRODUCTION

Indonesia is a multilingual country where most citizens speak more than one language, a local language, and Indonesian as the national language (Sobarna, 2007). In addition to these languages, Indonesians also learn English from the secondary school level, and this is the only compulsory foreign language taught in the Indonesian education system (Kirkpatrick & Sussex, 2012), where it is the second compulsory language learned in schools after Indonesian. Thus, English may not necessarily be a second language for Indonesians who speak local languages, but it may actually be their third language when they start learning it in secondary schools. One example of a regional language is Acehnese, the eighth most spoken language in Indonesia (Wirachmi, 2022).

In the context of Indonesia, there have been several studies on the production of English vowels by Indonesian speakers (Fata et al., 2017; Low, 2016; Perwitasari et al., 2016; Perwitasari et al., 2015). Widagsa (2015), for example, compared the production of English vowels by Indonesian speakers to Indonesian vowels. However, the Indonesian vowels were taken from another study, and thus, this comparison may not be reflective of the actual influence of Indonesian vowels on the production of English vowels. Further, the speakers who participated in the study were from various parts of Indonesia and were, therefore, likely to produce Indonesian vowels differently due to regional differences (Widagsa, 2015; Widagsa & Putro, 2017). Another study on vowels, compared English vowels to Sundanese and Javanese vowels (Perwitasari, 2019). However, this study did not account for Indonesian vowels and dismissed them as a subset of Javanese and Sundanese vowels, arguing that Sundanese and Javanese have more vowels than Indonesian, and thus, all vowels in Indonesian exist in Javanese and Sundanese. In both Widagsa (2015) and Perwitasari (2019), the multilingual nature of Indonesian speakers was not considered. In addition, there is a dearth of published studies comparing the production of English vowels to those in Indonesian or other regional languages.

Such comparisons are of interest as it has been posited that learners tend to filter non-native vowels through their existing first (L1) and second language (L2) sounds (Alispahic et al., 2017; Best & Tyler, 2007; Escudero, 2005; Flege, 1995), and in the context of Acehnese-Indonesian bilingual speakers, such filtering may affect the production of English vowels by these speakers. In relation to this point, and the lack of studies focusing on the influence of vowels from Indonesian and/or regional languages on the production of English vowels by Indonesian speakers, this study aims to begin filling this gap. In particular, this study aims to compare the quality of English vowels to equivalent Acehnese and Indonesian vowels produced by Acehnese-

Indonesian speakers, with a particular focus on learners in an Islamic boarding high school. This type of school is of particular interest because the school has a unique policy requiring students to speak English with their schoolmates and teachers during their three-year tenure at the school. The results of this study provide insights into how Acehnese speakers produce English monophthongs in relation to their production of Acehnese and Indonesian monophthongs. More specifically, this study addressed the following question:

- To what extent are equivalent monophthongs in English, Indonesian, and Acehnese produced similarly by the speakers?

2. LITERATURE REVIEW

2.1 The Perception and Production of Non-Native Sounds

Studies on the perception of non-native sounds, whether as an L2, third language (L3), or additional language, attempt to explain how language learners perceive non-native sounds in relation to the sounds in their existing language (Escudero, 2005). Lipińska (2015), for example, found evidence of a lack of separation in vowels across three languages among subjects whose L1 was Polish and English and German their L2 and L3 respectively. She found that the subjects perceived German /oe/ as being “similar” to Polish /u/, and sometimes merged it with English /ɔ:/ and Polish /ɔ/ (Lipińska, 2015, p. 88), and suggests that the subjects L1 and L2 influence their L3 production.

Another study of L3 German monophthongs compared the quality of these vowels to Malay and English monophthongs in order to observe the cross-linguistic influence of L1 Malay and L2 English on L3 German vowels (Yunus & Pillai, 2020). The findings suggest that speakers tend to produce equivalent L3 monophthongs with similar acoustic properties to their L1. For instance, L3 German monophthongs (/i/, /e:/, /ʊ/, /u:/, /ɔ/ and /a/) were produced with a similar quality to five equivalent Malay vowels (/i/, /e/, /u/, /o/ and /a/). Similarities between the production of the English and German vowels were also found, which suggests that the production of the former may have also influenced the way the German monophthongs were produced. At this juncture, it should be noted that the features of the English monophthongs of the speakers in this study were typical of those produced by Malaysian speakers of English in terms of vowel quality and the lack of quality contrast between typical vowel pairs (Pillai et al., 2010; Tan & Low, 2010). There was a tendency to collapse ‘new’ L3 monophthongs to closely located L1 or L2 vowels such as L3 German /ø:/ which was produced closer to English /ʊ/ (Yunus & Pillai, 2020).

2.2 Models of Speech Perception and Production

Many models have been proposed to explain how perception affects the acquisition of non-native sounds. These models include the Speech Learning Model (SLM) (Flege, 1995), Second Language Linguistic Perception (L2LP) (Escudero, 2005), and the Perceptual Assimilation Model (PAM) (Best, 1994; Best & Tyler, 2007).

The core idea of SLM is that the authentic production of L2 sounds often has a perceptual basis (Flege, 1995), where when learning L2 sounds, learners identify the L2 sounds through their existing L1 sounds (Flege, 1987). Flege (1991, p. 702) called this process of language processing “interlanguage identification”. Based on phonemic similarity between L1 and L2 and to represent how L2 learners perceive non-native sounds in relation to their L1 sounds, Flege (1987) taxonomically divided L2 sounds into three distinctive categories: identical, similar, and new. This comparison can be made through phonemic and phonetic comparisons. The former involves the universal representation of certain sounds by referring to the IPA symbols. Thus, if two sounds in two different languages share the same IPA symbol, the two sounds are considered ‘identical’. In addition, if the two sounds in two languages share the same symbol but one of them has an additional feature, such as lengthening, the two sounds are classified as ‘similar’. An example of this would be English /i:/ and Malay /i/. If the two sounds in the two different languages do not share the same IPA symbol, the two sounds are classified as ‘new’ (e.g., English /ɔ:/ and Malay /o/). However, the term ‘identical’ needs to be treated with caution because even though the same symbols are used to represent sounds from a different language, their actual quality in terms of production may be different as is the case with Malay and English /t/.

The second model, PAM, explains the acquisition of non-native sounds at the initial stage of language acquisition (Best, 1994; Best & Tyler, 2007). Initially, the model (Best, 1994) was developed to describe the way infants perceive new sounds in their L1 environment. The model was later extended to account for the acquisition of an L2 (Best & Tyler, 2007). PAM posits that when non-native listeners listen to non-native sounds, they will assimilate the sound to any similar L1 sounds due to experience of their native sounds into three possible categories based on their goodness fit to native sounds. They will hear the sounds as good or poor examples of their L1 sounds (categorized), distinct from any of their L1 sounds (uncategorized), or as ambient non-speech sounds (non-assimilated). While the categorized assimilation model can be divided into these three possible scenarios, their ease of acquisition is based on the two categories.

The first is the ‘two-category’ where two non-native contrasts are assimilated into two different native sounds. The second is the ‘single category’, where two non-native contrasts are assimilated into a single native phoneme, either as equally good or poor examples of the native phoneme. Discrimination varies from ‘good’ to ‘very good’ if one of two non-native contrasts is perceived as a member of one L1 while the other is not. This type of assimilation is named ‘category-goodness’, which has two additional possible assimilations. The first type is ‘categorized-uncategorized’, in which discrimination could be good if one of the contrasts is assimilated into the native sound (categorized) while the other is heard as a non-native sound (uncategorized). The second type is ‘uncategorized-uncategorized’. in which discrimination would be moderate if both sounds are heard as non-native sounds and are not assimilated to any existing L2 sounds.

The L2LP model by Escudero (2005) set out to fill the gaps in SLM and PAM. This is because PAM only accounted for the perception and production of non-native sounds at the initial stage of language development, while SLM accommodated the perception and production of non-native sounds at the end stage of language development. Thus, L2LP explains the perception and production of non-native sounds at the initial, developmental, and end stages of second language acquisition (Escudero,

2005). To explain the cross-linguistic influence of L1 and L2, the model expects that optimal perception of L1 and L2 sounds is first established (Escudero, 2005). Optimal perception is defined as the maximum-likelihood condition a person perceives a certain sound as the intended sound in the listener's production environment (Escudero, 2005). For example, if the vowel /i/ is produced at the F1 value of 280Hz and no other sound in this language is produced at this F1 value, it is 100% likely that this F1 value will be perceived as the front vowel /i/ in the said language. Thus, when determining the ease of acquisition of a target sound, the F1 and F2 values of the target sound are first determined as the optimal condition of the sound. When these values are compared to the optimal condition of the closest sound in speakers' L1, the optimal condition for L2 acquisition can be established. The optimal condition of this L2 sound depends on the vowel system of speakers' L1 and target language and the ability of the learners to perceive the distance between the optimal L1 condition and the optimal L2 condition.

In relation to this cross-linguistic comparison, the L2LP model put forward three possible scenarios and predictions of non-native vowel perception. The first is the 'new' scenario, which occurs when two non-native sounds are perceived as a single sound. The second is the 'subset' scenario which occurs when two non-native sounds are perceived as more than two existing L1 sounds. An example of this scenario is Dutch learners of Spanish perceiving Spanish /i/–/e/ as Dutch /i:/, /ɪ/, and /ɛ/. The third is a 'similar' scenario that occurs when L2 learners equate two non-native sounds to two existing native sounds. This scenario is considered very challenging for L2 learners because they are copying their L1 category to perceive the non-native sounds, and this full copying of L1 sounds is expected to occur among beginner L2 learners. For example, early Spanish learners of English tend to initially perceive English vowel contrast /i:/–/ɪ/ in the words 'sheep–ship' as Spanish /i/.

3. METHODS

This research is situated within the framework of positivism. It approaches the production and perception of sounds as an external reality that can be objectively observed and comprehended. Within this perspective, there is a belief in the existence of an external reality that can be explored and understood (Antonina, 2017). As a result, the researcher refrained from influencing the participants' sound production during data collection. The data collection process adhered to scientific methods, and subsequent analysis was conducted using statistical analysis (Grix, 2004). This ensures impartiality and objectivity throughout the research process, thus minimizing potential biases. Methodologically, the pursuit of truth relies on testing hypotheses through scientific experimentation and manipulation of observed conditions. The choice of employing the positivist paradigm led to the adoption of a quantitative approach, with the collected data subjected to statistical analysis for interpretation. The following sections explain the methods used in this study.

3.1 Speakers

A total of 29 students consisting of 14 males and 15 females (average age 18) were selected from a Modern Islamic Boarding School in Aceh. They were in their

first and second years of school and had scored 70 to 80 marks for English in the previous two semesters. They were all from the West Aceh region and were fluent in Acehnese and Indonesian. Written consent was obtained from the student participants prior to the data collection.

3.2 Data Collection

Three types of materials were administered to elicit the production of English, Indonesian, and Acehnese vowels. The materials for the English production tests consisted of ten words containing English monophthongs (see Appendix A). The monophthongs used in the study were based on American English monophthongs as described in [Ladefoged and Johnson \(2014\)](#). American English was selected because of its dominant position compared to British English, especially in popular media ([Gonçalves et al., 2018](#)). In Indonesia, major television channels tend to air American movies and series, which makes American English more commonly heard by Indonesian speakers. Nevertheless, the Indonesian school curriculum for English does not specify which English variety should be used ([Lauder, 2010](#)).

Words were selected where the target vowel appeared in a consonant-vowel-consonant (CVC) context. The target monophthongs for the Acehnese production test were also placed in a CVC context. Eleven words (see Appendix B) were selected, targeting eleven Acehnese oral monophthongs described in previous studies ([Asyik, 1987](#); [Durie, 1985](#); [Pillai & Yusuf, 2012](#); [Yusuf, 2013](#); [Yusuf et al., 2022](#)). For the Indonesian production test, seven Indonesian words targeting Indonesian monophthongs described in previous studies ([Soderberg & Olson, 2008](#); [van Zanten & van Heuven, 1984](#)) were used (see Appendix C). The target for Indonesian monophthongs was placed in CVCVC, with target vowels placed in the final CVC syllable except for Indonesian *tetap* ‘remain’ which is in the first CVC syllable. The students were required to read target words in a carrier sentence for each respective language:

English : *I say ... again.*

Indonesian : *Saya bilang ... lagi.* [I say ... again.]

Acehnese : *Nyoe lam Bahasa Aceh ...* . [This in Acehnese is]

The sentences containing the target words in English and Indonesian were presented on PowerPoint slides on a computer screen. For Acehnese, pictures associated with the target words and cue words in Indonesian were presented on the slides. This was because, unlike Indonesian, Acehnese does not have a standard spelling, and many spelling variations exist ([Santoso, 2013](#)). Thus, the students may be unfamiliar with one form of certain spelling. The students were recorded reading each word three times, producing 870 tokens for English, 870 tokens for Acehnese, and 609 tokens for Indonesian. This was done for all languages, starting from English, Indonesian, and Acehnese. The students were asked to pause for about three seconds between each sentence containing the target word. They finished all the words in one take before proceeding to the second and then third repetitions. All recordings were done in a quiet room in the computer laboratory at the school. The production test was recorded with a Zoom H6 recorder connected to a headset microphone. The recordings

were sampled at 44.000 Hz and 16-bit rate and recorded in the WAV format to maintain the quality of the recordings.

3.3 Data Analysis

The formant measurement was done in PRAAT version 6.2.14 (Boersma & Weenink, 2022). Only the first (F1) and second formants (F2) were measured to determine the quality of vowels. These two formants could be used to plot the quality of the vowels into the F2/F1 vowel space. Even though the quality of a vowel can be represented by many formants, the first two formants are adequate to represent the vowel quality in the vowel space. If F1 is similar between two vowels, they should have different F2 values to be considered as different vowels (Beňuš, 2021). The onset and offset of the vowel were determined by manually inspecting the waveform and spectrogram of the target vowel. As for quantitative data analysis, one-way ANOVA was used to ascertain whether the production of English vowels equivalent to Acehnese and Indonesian vowels exhibited any significant differences. In case significant results were recorded, a post hoc comparison using a Bonferroni adjustment was used to see if English vowels are significantly different from Acehnese, Indonesian, or both. Mauchly's Test of Sphericity was calculated to determine whether sphericity was violated. In order for the sphericity assumption to be met Mauchly's Test of Sphericity should be nonsignificant. Should the sphericity be violated, Greenhouse-Geisser is used if $\epsilon < 0.75$ in Mauchly's test, and Huynh-Feldt is used if $\epsilon > 0.75$ (Roever & Phakiti, 2017).

The classification of English vowels to equivalent Acehnese and Indonesian vowels was based on identical IPA symbols used to represent English, Acehnese, and Indonesian vowels. The use of phonetic symbols to compare the quality of sounds in a different language was also used in previous studies (Bohn & Flege, 1992; Flege, 1987) and, more recently, in the context of Indonesia (Perwitasari et al., 2016). Table 1 compares the English, Acehnese, and Indonesian monophthongs. English has ten monophthongs based on American English by Ladefoged and Johnson (2014), Acehnese has ten monophthongs based on the description by Asyik (1987), and Indonesian has six monophthongs based on the description by van Zanten (1986) and Soderberg and Olson (2008). Missing from the list of Indonesian monophthongs is /ɛ/, which van Zanten (1986) and Soderberg and Olson (2008) did not mention, but was included in data collection in the second syllable of the Indonesian *bebek* 'duck'. Furthermore, it is important to note that Acehnese has many dialects, but the vowels in this study were based on the Pase dialect, which has been used as the reference for studies on Acehnese vowels (Masykar et al., 2021; Pillai & Yusuf, 2012; Yusuf, 2013).

Table 1. Comparison of monophthongs across Acehnese (Asyik, 1987), Indonesian (Soderberg & Olson, 2008; van Zanten & van Heuven, 1984), and American English (Ladefoged & Johnson, 2014).

English	Acehnese	Indonesian
/i:/	/i/	/i/
/ɪ/	/e/	/e/
/ɛ/	/ɛ/	/ə/
/æ/	/u/	/a/
/ʌ/	/ə/	/u/
/ɑ:/	/ʌ/	/o/

Table 1 continued ...

/ɔ:/	/a/	
/ʊ/	/u/	
/ɜ:/	/o/	
/u:/	/ɔ/	

Based on IPA similarity, English vowels were classified into four categories (see Table 2). Similar to Acehnese and Indonesian vowels (SAI), Identical to Acehnese and Indonesian vowels (IAI), Identical to Acehnese vowels (IA), and Novel to Acehnese and Indonesian vowels (NAI). The first three sets of comparison comprise English /i:/, /ɔ:/, and /u:/. Acehnese and Indonesian vowels have similar vowels to these three English vowels but without vowel lengthening. This set was classified as SAI. The second set contains only one English /ɛ/, which has an identical sound in Acehnese and Indonesian. This set was classified as IAI. The third set also contains only one English /ʌ/, which has an identical sound only in Acehnese but not in Indonesian and was classified as IA. The findings were then interpreted with reference to SLM (Flege, 1987, 1995), PAM (Best, 1994; Best & Tyler, 2007), and L2LP (Escudero, 2005).

Table 2. Classification of English vowels to Acehnese and Indonesian vowels.

Classification	English	Acehnese	Indonesian
SAI	/i:/	/i/	/i/
	/ɔ:/	/ɔ/	/ɔ/
	/u:/	/u/	/u/
IAI	/ɛ/	/ɛ/	/ɛ/
IA	/ʌ/	/ʌ/	-
NAI	/ɪ/	/i/	/i/
	/ɑ:/	/ɔ/	/ɔ/
	/ʊ/	/u/	/u/
	/æ/	/ɛ/	/ɛ/
		/a/	/a/

SAI: Similar to Acehnese and Indonesian;

IAI: Identical to Acehnese and Indonesian;

IA: Identical to Acehnese;

NAI: New to Acehnese and Indonesian.

Note that the /ɒ/ and /ə/ vowels and diphthongs were not included in this study.

4. RESULTS

The following section presents the result of the study by comparing English vowels to Acehnese and Indonesian vowels produced by the students. Each English vowel is compared based on the classification made in Table 1.

4.1 English /i:/, and Indonesian and Acehnese /i/

English /i:/ is the first vowel in the Similar to Acehnese and Indonesian (SAI) category. The scatter plots comparing the production of English /i:/, and Indonesian and Acehnese /i/ by the Acehnese-Indonesian speakers are presented in Figure 1. As shown in the plots, the three vowels are clustered in the upper left section of the vowel space for both males and females. However, the vowels produced by the female speakers appear to be more spread out, while those by the male speakers are

concentrated in one area of the vowel space. English /i:/ and Indonesian /i/, on the other hand, are more spread out in the vowel space compared to Acehnese /i/ for the female speakers.

A one-way repeated-measures ANOVA indicated that the three vowels were not significantly different in terms of F1, $F(2,56)=1.09$, $p=0.343$, and F2, $F(2,56)=0.726$, $p=0.49$. This finding confirms the visual assumption that the English /i:/, and Indonesian and Acehnese /i/ were similar in terms of quality.

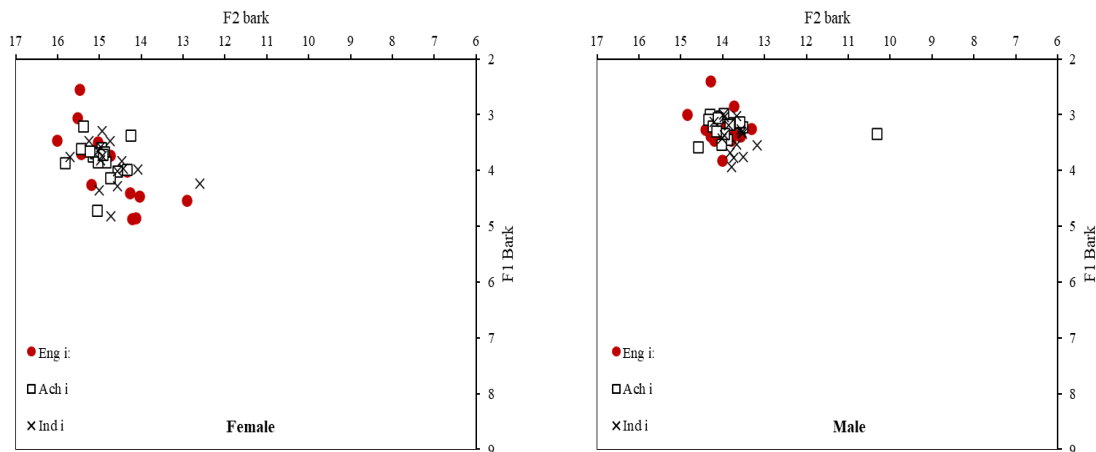


Figure 1. Scatter plots of English /i:/, Indonesian /i/, and Acehnese /i/.

4.2 English /ɔ:/, and Indonesian and Acehnese /ɔ/

English /ɔ:/ is the second vowel in the SAI category. The scatter plots comparing the production of English /ɔ:/, and Indonesian and Acehnese /ɔ/ by the speakers are presented in Figure 2. A visual inspection of the vowel distribution in the vowel space suggests that the production of the English /ɔ:/ differed from Acehnese and Indonesian /ɔ/. The placement of English /ɔ:/ in the vowel space indicates that this vowel was contrasted with Indonesian and Acehnese /ɔ/. The production of English /ɔ:/ was also more spread out among the female speakers. Acehnese and Indonesian /ɔ/ produced by the male speakers tended to concentrate on one area of the vowel space. Some female speakers produced English /ɔ:/ in close proximity to Acehnese and Indonesian /ɔ/. From the plots, it can be said that English /ɔ:/ was produced higher and more retracted for both male and female speakers. Acehnese and Indonesian /ɔ/ were produced lower and more fronted.

A one-way repeated-measures ANOVA indicated that the three vowels were significantly different in terms of F1, $F(2,56)=78.88$, $p<0.001$, and F2, $F(2,56)=117.52$, $p<0.001$. A post hoc comparison using a Bonferroni adjustment showed that F1 of English /ɔ:/ was significantly different from Acehnese /ɔ/ ($p<0.001$) and Indonesian /ɔ/ ($p<0.05$). The F2 of English /ɔ:/ was significantly different from Acehnese /ɔ/ ($p<0.001$) and Indonesian /ɔ/ ($p=0.001$).

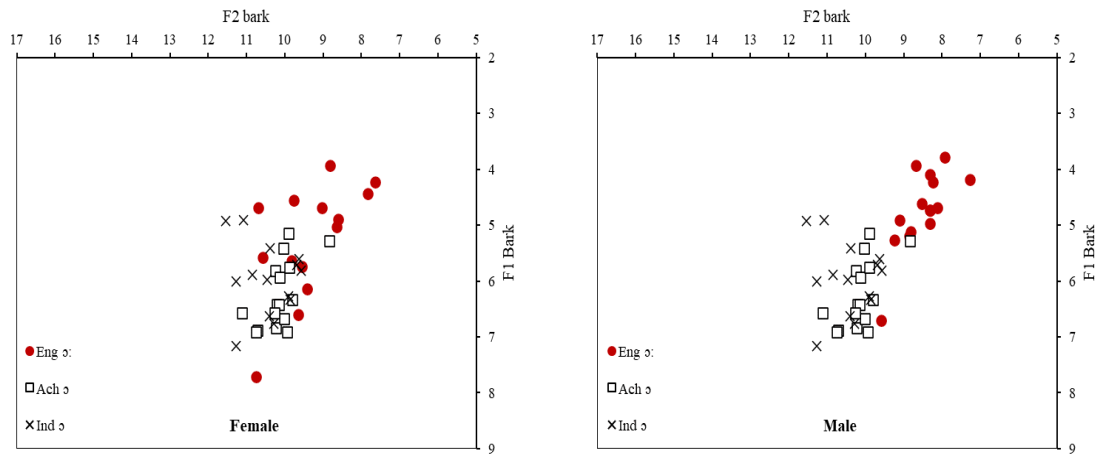


Figure 2. Scatter plots of English /ɔ:/, Indonesian /ɔ:/, and Acehnese /ɔ:/.

4.3 English /u:/, and Indonesian and Acehnese /u/

English /u:/ is the third and last vowel in the SAI category. The scatter plots comparing the production of English /u:/, and Indonesian and Acehnese /u/ by the speakers are presented in Figure 3. English /u:/ appears to have been produced distinctly from Indonesian /u/ but is more similar to Acehnese /u/. This pattern is mostly similar for both males and females. Acehnese /u/ is located more fronted, while in Indonesian, this vowel is located further back in the plots. English /u:/ appears to have been produced between Acehnese and Indonesian /u/.

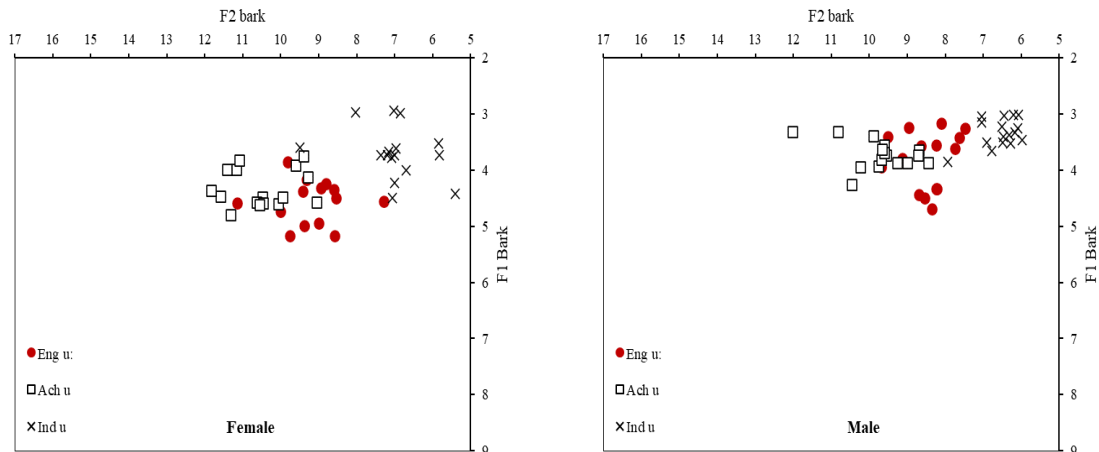


Figure 3. Scatter plots of English /u:/, Indonesian /u/, and Acehnese /u/.

However, a one-way repeated-measures ANOVA indicated that the three vowels were significantly different in terms of F1, $F(2,56)=17.564$, $p<0.001$, and F2, $F(2,56)=17.050$, $p<0.001$. A post hoc comparison using a Bonferroni adjustment showed that the F1 of English /u:/ was significantly different from Acehnese /u/ ($p<0.001$) but not significantly different from Indonesian /u/ ($p=1.00$). The F2 of English /u/ was not significantly different from Acehnese /u/ ($p=0.17$) but significantly different from Indonesian /u/ ($p<0.001$). These results suggest that the quality of English /u:/ may be considered a mix between the quality of Acehnese /u/ and Indonesian /u/. In terms of F1, English /u:/ was closer to Indonesian /u/, while in terms

of F2, English /u:/ was closer to Acehnese /u/. The speakers may be approximating the quality of English /u:/ through both Acehnese and Indonesian /u/. Compared to Acehnese and Indonesian /i/ and /ɔ/, where these vowels were produced similarly in terms of quality, Acehnese and Indonesian /u/ were produced quite distinctly.

4.4 English, Indonesian and Acehnese /ɛ/

The English vowel /ɛ/ is the only vowel classified in the Identical to Acehnese and Indonesian (IAI) category. The scatter plots comparing the production of English, Indonesian, and Acehnese /ɛ/ are presented in Figure 4. There were obvious overlaps of the three vowels for both male and female speakers, with the overlaps being more apparent for males. For the male speakers, the three vowels were concentrated in one location as if they were one indistinguishable vowel. For female speakers, Indonesian /ɛ/ appears to have been produced a little bit higher while Acehnese /ɛ/ was slightly more back in the plot than English /ɛ/. As can be seen in the plots, some productions of English /ɛ/ overlap with Indonesian /ɛ/, while some overlap with Acehnese /ɛ/.

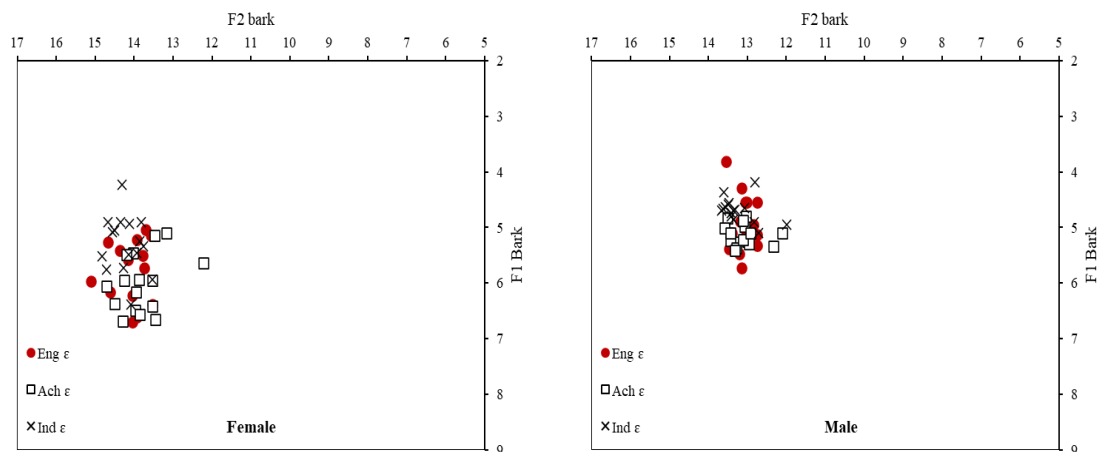


Figure 4. Scatter plots of English /ɛ/, Indonesian /ɛ/, and Acehnese /ɛ/.

A one-way repeated-measures ANOVA indicated that the three vowels were significantly different in terms of F1, $F(2,56)=23.107$, $p<0.001$, and F2, $F(2,56)=4.910$, $p<0.011$. A post hoc comparison using a Bonferroni adjustment showed that F1 of English /ɛ/ was significantly different from Indonesian /ɛ/ ($p<0.002$) but not significantly different from Acehnese /ɛ/ ($p=0.060$). The F2 of English /ɛ/ was not significantly different from Acehnese /ɛ/ ($p=0.082$) and Indonesian /ɛ/ ($p<0.066$). These findings suggest that the quality of English /ɛ/ was significantly different from Indonesian /ɛ/ in terms of F1 but not in terms of F2. The quality of English /ɛ/ and Acehnese /ɛ/ were not different in terms of F1 and F2. In other words, English /ɛ/ was produced with a similar vowel quality as Acehnese /ɛ/.

4.5 English and Acehnese /ʌ/ and Indonesian and Acehnese /a/

English /ʌ/ is the only vowel classified as Identical to Acehnese (IA). However, since the location in the vowel space of English /ʌ/ produced by these speakers is assumed to be close to Acehnese and Indonesian /a/, this vowel in both these languages is included in the analysis. The scatter plots comparing the production of English /ʌ/,

Acehnese /ʌ/, Acehese, and Indonesian /a/ by the speakers are presented in Figure 5. The placement of the vowels in the plots suggests that the quality of English /ʌ/ was different from that of Acehese /ʌ/ for both male and female speakers. Most female speakers produced English /ʌ/ similar to Acehese and Indonesian /a/.

A one-way repeated-measures ANOVA indicated that the three vowels were significantly different in terms of F1, $F(2,40)=20.51, p<0.001$ but F2, $F(2,56)=4.910, p=0.97$. A post hoc comparison using a Bonferroni adjustment showed that F1 of English /ʌ/ was significantly different from Acehese /a/ ($p<0.001$) but not significantly different from Indonesian /a/ ($p=0.626$). These results suggest that the quality of English /ʌ/ was significantly different from Acehese /a/ only in terms of F1 but not in terms of F2. The quality of English /ʌ/ and Indonesian /a/, on the other hand, were similar in terms of F1 and F2. In other words, English /ʌ/ was produced similarly to Indonesian /a/.

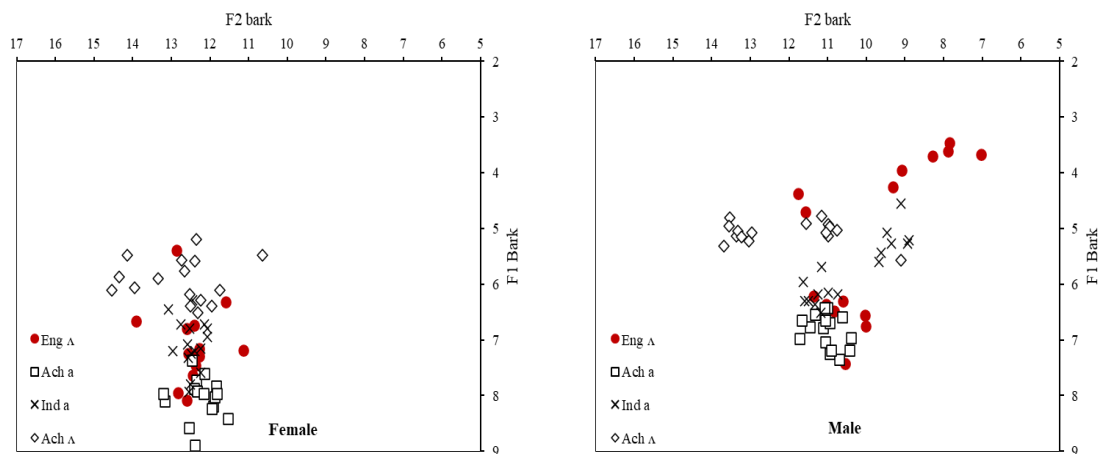


Figure 5. Scatter plots of English and Acehese /ʌ/ and Indonesian and Acehese /a/.

4.6 English /ɪ/, and Indonesian and Acehese /i/

English /ɪ/ is the first vowel in the New to Acehese and Indonesian (NAI) category. Unlike English /i:/, English /ɪ/ is novel to Acehese and Indonesian vowels. However, its proximity to Indonesian and Acehese /i/ may have led the Acehese-Indonesian speakers to approximate English /ɪ/ to native Acehese and Indonesian /i/. The scatter plots comparing the production of English /ɪ/, Indonesian /i/ and Acehese /i/ are presented in Figure 6. The placement of the vowels in the plots suggests that the three vowels were produced similarly by both males and females.

A one-way repeated-measures ANOVA indicated that the three vowels were not significantly different in terms of F1, $F(2,56)=.360, p=0.107$. As for F2, Mauchly's Test of Sphericity was significant $p<0.05$, and thus, the result of Hyun-Feldt was used with $\epsilon=0.814$. The results indicate that the three vowels were not significantly different in terms of F2 $F(2,56)=2.017, p=0.143$. No post hoc test was conducted since there was no significant difference for either F1 or F2 found among the three vowels. In other words, English /ɪ/ and Indonesian and Acehese /i/ were produced similarly in terms of their vowel quality.

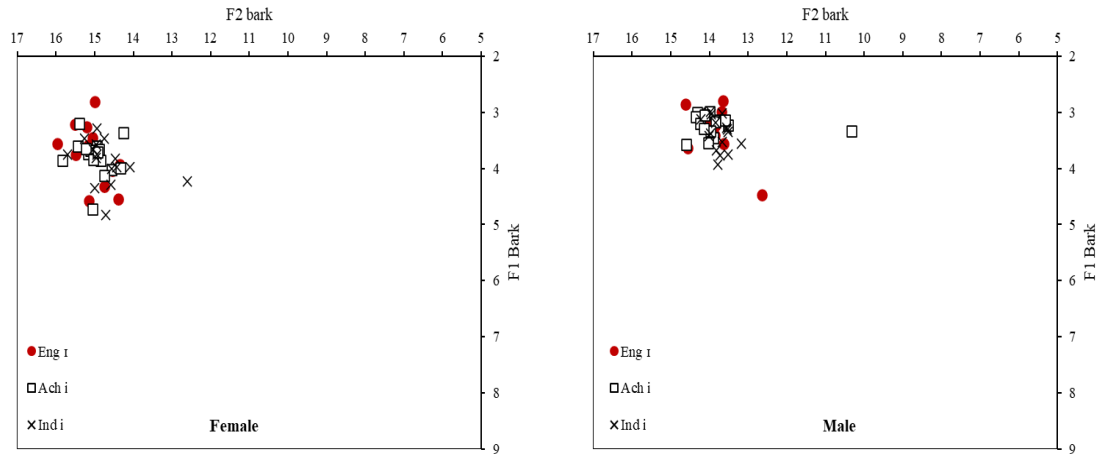


Figure 6. Scatter plots of English /i/, Indonesian /i/, and Acehnese /i/.

4.7 English /æ/, Acehnese and Indonesian /ɛ/ and /a/

English /æ/ is the second English vowel in the NAI category. Acehnese and Indonesian /ɛ/ is the closest vowel to English /æ/. However, since some students may also pronounce 'bat' based on its written orthography, the vowel /a/ in Acehnese and Indonesian was also compared with English /æ/. The scatter plots comparing the production of English /æ/ with Acehnese, Indonesian /ɛ/, and Acehnese and Indonesian /a/ are presented in Figure 7. The male and female speakers produced the English /æ/ with a different pattern. Most female speakers produced English /æ/ closer to Acehnese and Indonesian /ɛ/. On the other hand, the male speakers tended to produce English /æ/ closer to Acehnese and Indonesian /a/.

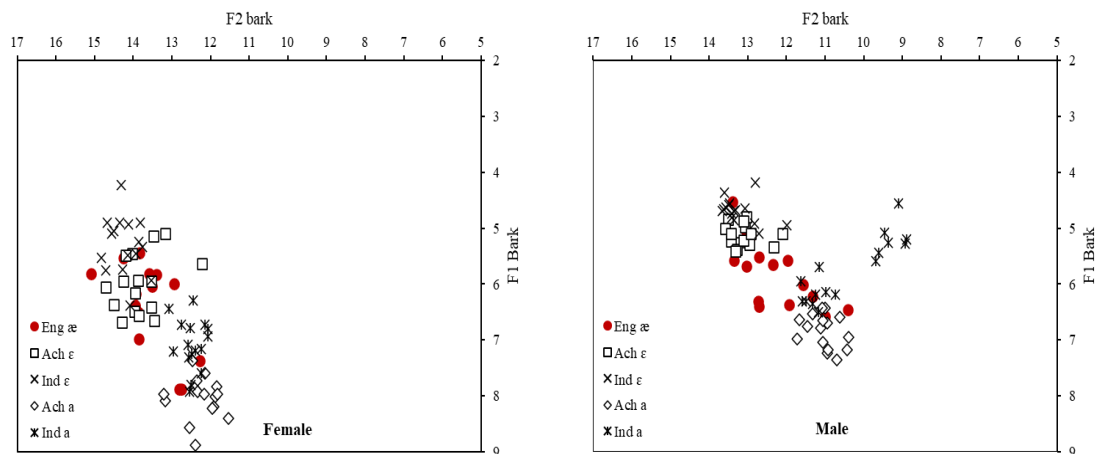


Figure 7. Scatter plots of English /æ/, Acehnese, and Indonesian /ɛ/ and Acehnese and Indonesian /a/.

A one-way repeated-measures ANOVA indicated that the five vowels were significantly different in terms of F1, $F(2,56)=129.66$, $p<0.001$, and F2 $F(2,56)=98.47$, $p<0.001$. A post hoc comparison using a Bonferroni adjustment showed that F1 of English /æ/ was significantly different from that of Acehnese /ɛ/ ($p<0.002$), Indonesian /ɛ/ ($p<0.001$), Acehnese /a/ ($p<0.001$), but not Acehnese /a/ ($p=0.484$). The F2 of English /æ/ was significantly different from Acehnese /ɛ/ ($p=0.013$), Indonesian /ɛ/ ($p=0.001$), Acehnese /a/ ($p=0.001$), and Indonesian /a/

($p=0.001$). These results suggest that English /æ/ was produced differently from Acehese and Indonesian /ɛ/ and Indonesian /a/ and was similar only in terms of vowel height with Acehese /a/.

4.8 English /ɑ:/, and Acehese and Indonesian /ɔ/

English /ɑ:/ is the third English vowel in the NAI category. Acehese and Indonesian /ɔ/ are the closest vowels to English /ɑ:/. The scatter plots comparing the production of English /ɑ:/, and Indonesian and Acehese /ɔ/ are presented in Figure 8. It is clear that there was a lack of separation between English /ɑ:/ and Indonesian and Acehese /ɔ/. For the male and speakers, the vowels in the three languages appear to be clustered together.

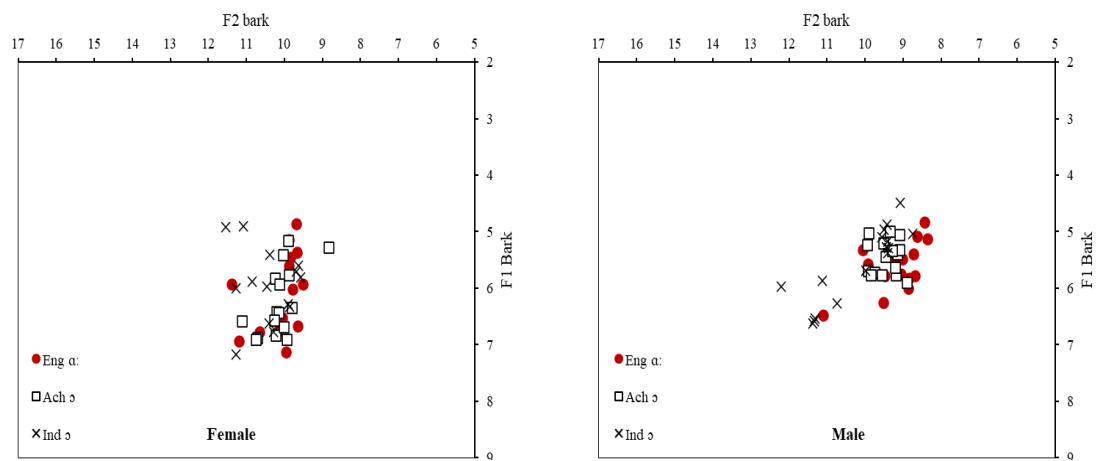


Figure 8. Scatter plots of English /ɑ:/, Indonesian /ɔ/, and Acehese /ɔ/.

A one-way repeated-measures ANOVA indicated that the three vowels were not significantly different in terms of F1, $F(2,56)=0.801$, $p<0.454$ but F2 $F(2,56)=5.492$, $p<0.023$. A post hoc comparison using a Bonferroni adjustment showed that F2 of English /ɑ:/ was significantly different from that of Indonesian /ɔ/ ($p<0.047$) but not from Acehese /ɔ/ ($p=0.33$). These results suggest that the quality of English /ɑ:/ was significantly different only from that of Indonesian /ɔ/ in terms of F2 but not in terms of F1. The quality of English /ɑ:/ and Acehese /ɔ/ was not different in terms of F1 and F2. In other words, English /ɑ:/ was produced similarly to Acehese /ɔ/ and higher than Indonesian /ɔ/.

4.9 English /ʊ/, and Indonesian and Acehese /u/

English /ʊ/ is the last English vowel in the NAI category. Unlike English /u:/, the vowel /ʊ/ is novel to Acehese and Indonesian. However, its close proximity to Indonesian /u/ and Acehese /u/ may have led to the Acehese-Indonesian speakers producing English /ʊ/ close to the two Acehese and Indonesian back vowels. The scatter plots comparing the production of English /ʊ/, and Indonesian and Acehese /u/ are presented in Figure 9, where English /ʊ/ was produced similarly to Acehese /u/ for both male and female speakers. The three vowels were similar in terms of F1 but differed across F2. This is evident from the placement of Acehese /u/ to the left

of the vowel space, while the Indonesian /u/ is to the right of the vowel space. Interestingly, English /ʊ/ is placed between Acehnese /u/ and Indonesian /u/.

A one-way repeated-measures ANOVA indicated that the three vowels were significantly different in terms of F1, $F(2,56)=21.893$, $p<0.001$, and F2 $F(2,56)=52.565$, $p<0.001$. A post hoc comparison using a Bonferroni adjustment showed that the F1 of English /ʊ/ is not significantly different from that of Acehnese /u/ ($p=0.08$) but significantly different from Indonesian /u/ ($p<0.05$). F2 of English /ʊ/ was not significantly different from Acehnese /u/ ($p=0.17$) but significantly different from Indonesian /u/ ($p<0.01$). The results suggest that the quality of English /ʊ/ was different from Indonesian /u/ but similar to Acehnese /u/.

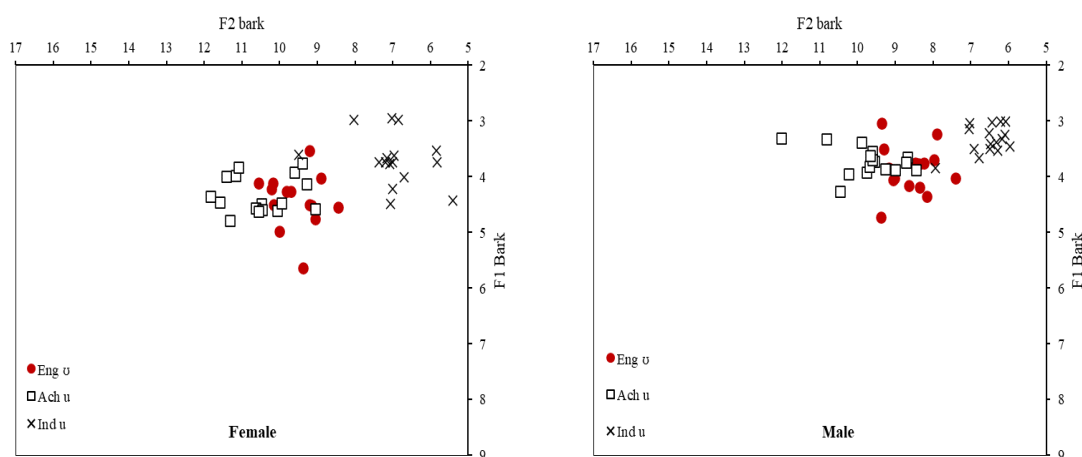


Figure 9. Scatter plots of English /ʊ/, and Indonesian and Acehnese /u/.

5. DISCUSSION

As previously mentioned, SLM, PAM, and L2LP concur that when learning a new language, L2 learners tend to filter the target language sound through their existing sounds (Alispahic et al., 2017; Best & Tyler, 2007), and thus, the production of non-native sounds, at least in their initial stage of development, may resemble some existing native vowels. This study found that the production of English vowels is, to some extent, related to how Acehnese and Indonesian vowels are produced. In other words, the quality of some English vowels may be similar to Acehnese and Indonesian vowels, especially for vowels that have a similar quality to native vowels.

Table 3 summarises the comparisons of English monophthongs with those in Indonesian and Acehnese.

Table 3. Comparison of the quality of English vowels with Acehnese and Indonesian vowels by Acehnese-Indonesian English speakers.

Similarities	Examples
Produced similarly to L1 Acehnese and L2 Indonesian vowels	English /ɪ/ and English /i:/ → L1 Acehnese and L2 Indonesian /i/
Produced similarly to L1 Acehnese but not to L2 Indonesian vowel	English /ʊ/ → L1 Acehnese /u/ only

Table 3 continued...

Produced more similarly to L1 Acehnese than to L2 Indonesian	English /ɛ/ → L1 Acehnese /ɛ/ with some similarities to L2 Indonesian /ɛ/ English /ɑ:/ → L1 Acehnese /ɔ/ with some similarities to L2 Indonesian /ɔ/.
Produced more similarly to L2 Indonesian than to L1 Acehnese	English /ʌ/ → L2 Indonesian /a/ with some similarities to L1 Acehnese /a/
Produced with some similarities to both L1 Acehnese and L2 Indonesian	English /u:/ → L1 Acehnese /u/ in terms of vowel height (F1) and L2 Indonesian /u/ in terms of vowel fronting/retraction (F2).

In the case of English /i:/ and /ɪ/, they were produced similarly to Acehnese and Indonesian /i/, thus resulting in a loss of phonemic distinction between the English vowels. Such loss has been reported in neighbouring varieties of English (Deterding, 2003; Pillai et al., 2010; Sharbawi, 2006; Tan & Low, 2010). The L2LP model (Escudero, 2005) classified this type of assimilation as a ‘new’ category. In the PAM model (Best & Tyler, 2007), this is referred to as ‘single-category’ assimilation. Thus, when producing the two vowels, the Acehnese-Indonesian speakers in this study may have been referring to their existing vowels, that is, Acehnese and Indonesian /i/, and produced both /i:/ and /ɪ/ as /i/. This may have happened because Acehnese and Indonesian only have one high-front vowel, /i/, and thus, the speakers may have mapped the novel English /ɪ/ to Acehnese and Indonesian /i/.

In the second case, partial similarities in vowel quality were found, and sometimes with either Acehnese or Indonesian, especially when there was a discernible difference in vowel quality between the latter two vowels. For instance, English /ʊ/ was produced similarly to Acehnese /u/ but distinct from Indonesian /u/. In the case of /u:/, only one aspect of vowel quality was similar to Acehnese and Indonesian vowels because Acehnese and Indonesian /u/ do not actually share the same properties in terms of vowel height. Thus, in this study, English /u:/ shared similar properties to Acehnese and Indonesian /u/, but the difference is in terms of vowel fronting, the vowel was produced similarly to Acehnese /u/, while in terms of height, it was similar to Indonesian /u/. This can be said to fall under the ‘two-category’ scenario in PAM (Best & Tyler, 2007) and the ‘similar’ scenario in L2LP (Escudero, 2005).

A similar scenario was also observed for English /ʌ/, where the speakers produced this vowel similarly to Indonesian /a/ but not Acehnese /ʌ/. One possible explanation for this is that in the dialect of the current speakers, the West Aceh dialect, the vowel /ʌ/ is different in terms of vowel quality from the Acehnese dialect in Pase (Pillai & Yusuf, 2012). The different realization of Acehnese /ʌ/ in the West Aceh dialect was first raised in studies on West Acehnese (Masykar et al., 2021). The studies found that Acehnese speakers from West Aceh produced the Acehnese /ʌ/ in the word *göt* as /ə/, /ɛ/, and /ɔ/. Such variation may have resulted in the speakers having a different realization of Acehnese /ʌ/. However, it is not clear why English /ʌ/ was realized as Acehnese and Indonesian /a/ instead of any variation of Acehnese /ʌ/ from the West Aceh dialect. Thus, it is safe to assume that for the current speakers, English /ʌ/ has the same quality property as Acehnese and Indonesian /a/.

In the case of English /ɑ:/, which is novel to both Acehnese and Indonesian vowel systems, it tended to be realized similar to the mid-back Acehnese and Indonesian /ɔ/. English /ɑ:/, and Acehnese and Indonesian /ɔ/ shared the same quality in terms of vowel fronting but differed considerably in terms of height. This scenario

was also observed in English /ɛ/, Acehnese and Indonesia /ɛ/. English /ɛ/ was produced similarly to Acehnese /ɛ/ compared to Indonesian /ɛ/ but with some similarity to Indonesian /ɛ/ in terms of vowel fronting.

In the third case, /æ/ and /ɔ:/ were produced with a significantly different quality from equivalent Acehnese and Indonesian vowels. The quality of English /æ/, which is novel to Acehnese and Indonesian vowels, was different from any existing Acehnese and Indonesian central vowels. The differences were contributed mainly by the fact that some speakers produced English /æ/ similarly to Acehnese and Indonesian /ɛ/ while some speakers produced it similarly to Acehnese and Indonesian /a/. The quality of English /ɔ:/ was different from either Acehnese or Indonesian /ɔ/. This result is particularly interesting considering that English /ɔ:/ has comparable vowels in Acehnese and Indonesia.

6. CONCLUSION

Through a comparison of the quality of English vowels to equivalent L1 Acehnese and L2 Indonesian vowels produced by Acehnese-Indonesian speakers, this study found that Acehnese-Indonesian speakers produced some English vowels similar to existing L1 Acehnese and L2 Indonesian vowels, and the similarity appeared to be more pronounced toward L1 Acehnese than L2 Indonesian.

The findings of this study provide insights into how Acehnese-Indonesian learners filter English vowels through their existing L1 and L2 sounds and allow for a better understanding of this phenomenon via existing conceptual models. The findings also point to the often-ignored influence of other languages in a speaker's repertoire on the learning and production of a new language. However, given the limitations of this study in relation to the sample type and size, as well as the test words that were used, further studies with a bigger sample, different test words, other speaking contexts, and speakers with different levels of proficiencies could provide more insights into the influence of sounds from existing languages on new languages being learned by multilingual Indonesian speakers. Lastly, this study did not consider the potential impact of Acehnese diphthongs and nasal sounds on the pronunciation of English vowel sounds, which should be the focus of future research.

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APPENDICES

Appendix A

Table A1. Word list for English monophthongs

No	Target Words	Target Vowels
1	pot	/ɑ:/
2	bit	/ɪ/
3	beat	/i:/
4	bet	/ɛ/
5	bat	/æ/
6	bud	/ʌ/
7	foot	/ʊ/
8	food	/u:/
9	port	/ɔ:/
10	bird	/ɜ:/

Appendix B

Table B1. Word list for Acehnese monophthongs.

No.	Target Words	Word Class	Target Vowel	English
1	<i>cit</i>	adverb	/i/	‘too, also’
2	<i>cut</i>	noun	/u/	‘small, title for women of noble descent’
3	<i>pét</i>	verb	/e/	‘close / shut eyes’
4	<i>tet</i>	verb	/ə/	‘burn’
5	<i>pôt</i>	verb	/o/	‘blow, to fan’
6	<i>göt</i>	adjective	/ʌ/	‘good, fine’
7	<i>cop</i>	verb	/ɔ/	‘sew’
8	<i>pat</i>	conjunction	/a/	‘where’
9	<i>peut</i>	adjective	/u/	‘four’
10	<i>cèt</i>	verb	/ɛ/	‘paint’

Appendix C

Table C1. Word list for Indonesian monophthongs.

No.	Target Words	Target Vowels	Glossary
1	<i>bibit</i>	/i/	‘seed’
2	<i>bubuk</i>	/u/	‘powder’
3	<i>bebek</i>	/ɛ/	‘duck’
4	<i>babat</i>	/a/	‘food from animal abdomen’
5	<i>bobot</i>	/ɔ/	‘weight’
6	<i>bobok</i>	/o/	‘sleep’
7	<i>tetap</i>	/ə/	‘remain’