An Acoustic Description of Diphthongs in Two Varieties of Acehnese

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ABSTRACT

This paper complements current descriptions of Acehnese pronunciation by not only comparing two varieties of Acehnese but also by carrying out an acoustic analysis of the diphthongs in these varieties. Given that there is a dearth of empirical research on pronunciation differences between the standard variety of Acehnese spoken in Aceh and other varieties of Acehnese, this paper examines the acoustic features of oral diphthongs based on Asyik’s (1987) inventory of oral diphthongs. The data comprised diphthongs produced by ten female speakers of the North Aceh dialect (which is considered the standard form of Acehnese) and ten female speakers from Kampung Aceh in Kedah, Malaysia. Acehnese is still spoken in Kampung Aceh by descendants of Acehnese who settled in the area in the late 18th century. Based on the measurements of the Rate of Change of the first and second formants of the target diphthongs and an examination of the onset and offset positions of these diphthongs in the vowel space, it was found that there were fewer diphthongs in the Kampung Aceh variety compared to that of the North Aceh. A possible reason for this is the influence of the Kedah Malay dialect and Standard Malay. The diphthongs produced by the Acehnese speakers also displayed some differences from the ones described by Asyik (1987).

Keywords: Acehnese, oral diphthongs, acoustic, rate of change, North Aceh, Kampung Aceh

INTRODUCTION

Acehnese is one of the local languages spoken in the Province of Aceh in Indonesia. Besides Acehnese, there are eight other distinct local languages spoken in Aceh (Wildan et al., 1999), but Acehnese has
the most number of speakers (Asyik, 1987; Hanoum et al., 1986). Acehnese itself is divided into four main dialects, namely the Greater Aceh, Pidie, North Aceh and West Aceh dialects (Asyik, 1987). The North Aceh dialect is considered as the standard form of Acehnese by scholars (e.g. Asyik, 1987; Durie, 1985; Hanafiah & Makam, 1984; Sulaiman et al., 1977; Sulaiman et al., 1983) due to its consistent language structure and large number of speakers. This dialect is considered as “phonologically homogeneous” compared to the other Acehnese dialects (Asyik, 1987, p. 6).

Acehnese is also spoken in some parts of Malaysia by Acehnese descendants, such as in Kedah in the northwest of Peninsular Malaysia (Asmah, 1992; Durie, 1985; Daud & Durie, 2002). One community that is still dominated by Acehnese descendants is the one in Kampung Aceh in Kedah (Azrul, 2012a; Esham, 1998). Their ancestors arrived in this area around the late 18th century because of trade and political turmoil in Aceh due to Dutch occupation of the region (Azrul, 2012b; Esham, 1998; Panyot Ceulot, 2007).

Acehnese is still widely spoken among the Acehnese descendants in Kampung Aceh (Azrul, 2012c). In 2008, a demographic survey conducted by the authors on the residents of this village revealed that 64% of the 104 residents of Acehnese descent still speak Acehnese as their dominant home language, while 19% use it together with the Kedah Malay dialect. However, the passage of time and contact with the Kedah Malay dialect, Standard Malay and other local languages are likely to have influenced the variety of Acehnese used in Kampung Aceh (henceforth, KpA). One of the observable differences lies in the pronunciation features of the Acehnese used in KpA. However, to date, there is a lack of empirical research on pronunciation differences between the standard variety of Acehnese spoken in Aceh (henceforth, Ach) and other varieties of Acehnese. Part of this research gap may be due to the fact that almost all descriptions of Acehnese pronunciation are based on auditory descriptions. There are also hardly any acoustic studies on the sounds of Standard Malay and Malay dialects. Thus, there is a need to transform the research on Acehnese pronunciation through the use of instrumental analysis of its sounds and to also begin comparing phonological variation in the different varieties of Acehnese across geographical borders. To begin to address this research gap, this paper examines the acoustic features of two varieties of Acehnese, namely, the one spoken in Indonesia (Ach) and the one in Kedah, as represented by the community in Kampung Aceh (KpA). More specifically, the study described in this paper focuses on the Acehnese diphthongs produced by speakers in Ach and KpA. Diphthongs are of particular interest because while Standard Acehnese has many diphthongs (see next section), it is anticipated that the variety spoken in KpA may have fewer of these sounds due to a simplification of sounds and the influence of the local Malay dialect.
ACEHNESE PRONUNCIATION

Asyik (1987, pp. 17-18) describes Acehnese as having 12 oral diphthongs. His inventory of diphthongs is based on an impressionistic analysis of North Aceh speakers, and is divided into two sets, namely, diphthongs with a central offglide and those with a rising offglide (see Table 1). Most textbooks and dictionaries on Acehnese employ Asyik's (1987) vowel and consonant inventory (e.g. Daud & Durie, 2002; Hanafiah & Adam, 2000; Wildan et al., 1999; Wildan, 2002), although there are other descriptions of Acehnese sounds available (e.g. Durie, 1985; Hanafiah & Makam, 1984; Sulaiman et al., 1977). Unlike Asyik (1987), Sulaiman et al. (1977, pp. v-vi) and Sulaiman et al. (1983, p. 8) describe Acehnese as having only nine oral diphthongs (/ai/, /ɛə/, /iə/, /ɯə/, /oi/, /uə/, /ui/, /əi/ and /ɔə/) although their description is also based on the North Aceh speakers. Durie (1985, p. 17), whose data were also based on North Aceh speakers, describes only five oral diphthongs, which are /iə/, /uə/, /ɛə/, /ɯə/ and /ɔə/, and completely ignores the rising diphthongs which can be found in Acehnese. Similar to Durie (1985), Al-Harbi (2003) also describes five oral diphthongs with data taken from Acehnese speakers from the Pidie dialect who were studying in Madina, Jeddah and Mecca at the time of the study.

TABLE 1
Acehnese oral diphthongs

<table>
<thead>
<tr>
<th>Diphthongs</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centering Diphthongs</td>
<td></td>
</tr>
<tr>
<td>/ia/</td>
<td>khiie /khiə/ ‘rancid’, hiem /hiəm/ ‘hint, lyrics’</td>
</tr>
<tr>
<td>/ua/</td>
<td>keue /kuə/ ‘front’, juet /jɯət/ ‘become, may, can’</td>
</tr>
<tr>
<td>/ua/</td>
<td>hue /huə/ ‘pull’, bruek /brɯək/ ‘coconut shell’</td>
</tr>
<tr>
<td>/ea/</td>
<td>ulee /uə/ ‘head’, lagee /lɛə/ ‘as, like, such’</td>
</tr>
<tr>
<td>/ea/</td>
<td>dhoie /dɯə/ ‘clogged up’, lagoe /lɛə/ ‘particle for surprise’</td>
</tr>
<tr>
<td>/ea/</td>
<td>troe /trə/ ‘full stomach’, tampoe /tampə/ ‘mend, hold’</td>
</tr>
<tr>
<td>Rising Diphthongs</td>
<td></td>
</tr>
<tr>
<td>/ai/</td>
<td>hei /həi/ ‘to call’</td>
</tr>
<tr>
<td>/ui/</td>
<td>phui /pɯə/ ‘lightweight’, reului /rəulu/ ‘shady, cool’</td>
</tr>
<tr>
<td>/i/</td>
<td>lagoin /lɛən/ ‘very beautiful’</td>
</tr>
<tr>
<td>/i/</td>
<td>dboi /ˈdhoi/ ‘ash’, çantoi /ˈʃəntoi/ ‘awkward’</td>
</tr>
<tr>
<td>/oi/</td>
<td>boi /ˈboi/ ‘nickname from the name Boihaqi’, boinah /ˈboiənə/ ‘property’</td>
</tr>
<tr>
<td>/ai/</td>
<td>sapai /ˈsapəi/ ‘arm’, bangai /ˈbanəi/ ‘stupid, foolish’</td>
</tr>
</tbody>
</table>

METHODOLOGY

Speakers

The speakers in this study comprised 20 female speakers with ten from each KpA and Ach. All the speakers had no reported speech or hearing impediments (see Pillai & Yusuf, 2012).

The Ach speakers were from Lhokseumawe, and were annotated as
Ach1, Ach2 and so forth, to Ach10. Their age ranged from 45-60 years, with a mean age of 54 years. The younger generations of Acehnese today are found to be progressively using more Bahasa Indonesia, particularly in urban areas like Banda Aceh (see Alamsyah et al., 2011). Therefore, important criteria for the selection of these speakers were that although they are all fluent in Bahasa Indonesia, they speak the North Aceh dialect as their first language, and they use it at home with their spouses and children, and with community members in informal contexts.

The speakers from KpA in Kedah were annotated as KpA1, KpA2 and so forth, to KpA10. They were all from the 4th generation of Aceh descendants, and just like the Ach speakers, were aged between 45-60 years, with a mean age of 54 years. They have acquired Acehnese as their first language and speak it fluently, using it with family members and fellow Acehnese in the village. This group was selected based on the feedback obtained from the residents during our demographic survey to the village in 2008. From the informal interviews which focused on their use of Acehnese at home, 57 residents participated, in providing the information. It was found that the Acehnese residents from the fourth generation (aged between 41-60 years) had only learned Malay at the age of seven when they first started primary school. Therefore, they consider Acehnese as their mother tongue and it remains the language of the home.

Data and Instrumentation

To ensure that all of the oral diphthongs in Asyik’s inventory were obtained from both sets of speakers, 12 words containing these vowels (see Appendix) were selected. In order to avoid the effects of adjoining sounds, the vowels were placed in words that were preceded and followed by stops and fricatives in CVC or CV position (King, 2006; Tsukada, 2008) as these manners of articulation have minimal effect on preceding vowels (King, 2006). In Acehnese, vowels can occur in both closed and open syllables. However, for /eə/ and /oə/ (see Durie, 1985, p. 21) as well as /oi/, /ui/, /ai/, /oi/ and /ai/ they only appear in open syllables in the North Aceh dialect. The target words were commonly used words and were chosen with reference to word samples provided in Asyik (1987), Durie (1985), Sulaiman et al. (1977), Wildan (2002) and dictionary entries (Hanafiah & Adam, 2000; Daud & Durie 2002).

Data were collected by eliciting the target words by using picture cards and questions (see Walters, 2006). For example, to obtain the word bhôi [bhoi] ‘sponge cake’ the speakers were shown a picture of a sponge cake and asked Peu nan kueh nyoe? ‘What is the name of this cake?’ When they had provided the correct answer, they were asked to repeat the target word three times at a normal speaking rate, resulting in a total of 720 words containing the target diphthongs that were then acoustically examined.

They were not asked to read the target words in a series of sentences because Acehnese was essentially used in a spoken
rather than a written form. Further, the focus was on obtaining more naturalistic speech production (see Ladefoged, 2003). The Ach speakers were recorded in a soundproof room in Universitas Syiah Kuala, Banda Aceh, while the KpA speakers were recorded in a quiet room in Kampung Aceh. Both sets of speakers were recorded using a Marantz PMD661 Solid State Sound Recorder with Audio-Technica ATM73 head worn microphones. The recordings were sampled at 44,100 Hz.

ANALYSIS

Data were segmented, annotated and measured using Praat version 4.6.12 (Boersma & Weenink, 2007). The spectrographic display in Praat was set at the view range of 5500 Hz as this is the frequency range that is commonly adjusted for female speakers (Chen, 2008; Ladefoged, 2003). The formant values were automatically tracked by the Linear Predictive Coding (LPC) analysis overlaid on digital spectrograms. However, occasionally the LPC did not produce accurate readings, and in such cases, the formant frequencies were measured manually.

It can be assumed that the formants for diphthongs will not be stable as they are characterized by the changing of vowel quality from the onset to the offset of the vowel (Ladefoged, 2006). Therefore, to capture the change in vowel quality, Gay (1968) recommends measuring the Rate of Change (ROC) for the first formant by applying the following formula (Deterding, 2000):

\[ \text{ROC} = \frac{F_{1\text{end}} - F_{1\text{onset}}}{\text{duration in seconds}} \]

The ROC can be expected to have a negative value for a rising diphthong like /ai/ because as the diphthong moves from a lower to a higher vowel, F1 will decrease. The use of ROC as a method for examining diphthongs has been employed in other studies as well (see for e.g. Deterding, 2000; Lee & Lim, 2000; Salbrina, 2006; Tsukada, 2008). Similarly, Lee and Lim (2000) also recommend measuring the ROC for the second formant for the centering diphthongs as the F1 ROC is unlikely to reflect the fronting/retraction dimension. As Acehnese comprises both the rising and centering diphthongs, the ROC values were calculated for both F1 and F2. Whilst Deterding (2000) and Salbrina (2006) had measured the diphthongs at the onset and offset of the vowel, we measured the vowels at 20% and 80% into the diphthong to avoid the possible influence of neighbouring consonants (see Tsukada, 2008). Fig.1 shows an example of the annotations for the diphthong /ua/ in buet ‘work’, with the F1 and F2 onset and offset shown in Tiers 4 and 5 and the vowel duration shown in Tier 6, respectively.

![Fig.1: Spectrogram of the word ‘buet’ produced by Ach3](image)
The average F1 and F2 values at the onset and offset of each diphthong were also plotted in a vowel chart to obtain a visual representation of their trajectories (see Man, 2007; King et al., 2009; Mayr & Davies, 2011). In addition, independent samples t-tests were also carried out to compare the average ROCs of the F1 and F2 between the two sets of speakers.

RESULTS

Centering Diphthongs

The average F1 and F2 ROC values for the centering diphthongs produced by Ach and KpA are shown in Table 2.

Based on their average ROCs values, each centering diphthong is discussed in the following sections. In the figures which show the trajectories of the diphthongs in the vowel space, the two ends of the arrow represent the onset and offset of a diphthong.

i. The diphthong /iə/ in tiep

For /iə/, both the average F1 and F2 ROCs for the Ach speakers are bigger than for the KpA speakers, which suggest that Ach /iə/ was produced with greater diphthongal movement than KpA. This is supported by an independent samples t-test, which showed significant differences between Ach and KpA average F1 and F2 ROCs (F1: t(58)=4.43, p<.0001; F2: t(58)=7.73, p<.0001), indicating that this diphthong was produced differently by the two groups of speakers. Fig.2 shows spectrograms of tiep produced by Ach4 and KpA1, where the arrow illustrates the steady state of the vowel produced by KpA1 compared to the downward movement of F2 for Ach4. The trajectory of /iə/ by both speakers in Fig.3 also implies that KpA produced this vowel as a long monophthong, auditory discerned as /i:/.

Fig.2: Spectrograms of the word ‘tiep’ produced by Ach4 and KpA1

TABLE 2
Average F1 and F2 ROC values for centering diphthongs

<table>
<thead>
<tr>
<th>Target Word</th>
<th>Diphthong</th>
<th>Ach Informants</th>
<th>KpA Informants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>F1 ROC (Hz/sec)</td>
<td>F2 ROC (Hz/sec)</td>
</tr>
<tr>
<td>tiep</td>
<td>/iə/</td>
<td>483 (577)</td>
<td>-6456 (3126)</td>
</tr>
<tr>
<td>beuet</td>
<td>/ɯə/</td>
<td>689 (698)</td>
<td>3493 (2053)</td>
</tr>
<tr>
<td>buet</td>
<td>/uə/</td>
<td>882 (705)</td>
<td>4123 (1791)</td>
</tr>
<tr>
<td>kée</td>
<td>/ɛə/</td>
<td>131 (450)</td>
<td>-616 (786)</td>
</tr>
<tr>
<td>dhöe</td>
<td>/ʌə/</td>
<td>-1026 (537)</td>
<td>-2330 (1720)</td>
</tr>
<tr>
<td>toe</td>
<td>/ↄə/</td>
<td>-690 (802)</td>
<td>-1001 (1124)</td>
</tr>
</tbody>
</table>

*Standard deviations in parentheses
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ii. /uə/ in beuet

The sound /uə/ in beuet was produced slightly more diphthongal by Ach compared to KpA as Ach average F1 and F2 ROCs are slightly larger than KpA. A significant difference was found between average F1 ROCs (t(58)=6.47 p<.0001) as shown in Fig.4, where the onset of /uə/ by Ach is more back compared to KpA. There was, however, no significant difference in the average F2 ROCs from both the informants (F2: t(58)=2.93, p=0.002). Furthermore, the trajectory of /uə/ in KpA approximates /ɨ/ which suggests that it may be produced as a long /ɨ:/.

iii. /uə/ in buet

The average F1 and F2 ROCs from Ach /uə/ in buet are also bigger than KpA, suggesting that Ach /uə/ was produced with a more diphthongal movement than KpA. A significant difference between the average F1 ROCs was found (t(58)=6.05, p<.0001). Fig.5 also shows that the onset of Ach /uə/ is slightly more back compared to KpA, but no significant difference was found between average F2 ROCs (t(58)=1.17, p=0.123).

iv. /ɛə/ in kée

Despite the fact that the average F1 and F2 ROCs for Ach show a little more diphthongal movement than the KpA /ɛə/ in kée, no significant differences were found in the average F1 and F2 ROCs between the informants (F1: t(58)=1.07, p=0.145; F2: t(58)=3.51, p=0.0004). In addition, the trajectory of /ɛə/ in Fig.6 also illustrates very little diphthongal movement by the Ach speakers, while no movement at all is seen for the KpA speakers. This suggests that /ɛə/ was produced as a long monophthong /ɛ:/ by both the informants.
vi. /ɔa/ in toe

The slightly larger average F1 and F2 ROCs from Ach for /ɔa/ in toe indicate that it was produced with a more diphthongal movement compared to KpA. However, no significant differences were found between the average F2 ROCs of KpA and Ach (F1: t(58)=0.51, p=0.306; F2: t(58)=0.6, p=0.275). Moreover, the negative values for the average F2 ROCs for both sets of speakers show that the trajectories are moving towards the back of the vowel space, as illustrated in Fig.8. The Ach diphthong is moving towards a high back position approximating /u/, suggesting that it was realised closer to /ɔa/, whereas for the KpA, it is moving towards /ɔ/, sounding similar to /ɔo/.

Auditorily, it appeared that the KpA informants produced the diphthong in both dhöe and toe as /ɔo/. Nonetheless, independent samples t-tests showed no significant differences (F1: t(58)=0.45, p=0.327; F2: t(58)=0.73, p=0.234), suggesting that the diphthong in both words were produced similarly.
Rising Diphthongs

The average F1 and F2 ROC values for the rising diphthongs produced by Ach and KpA are shown in Table 3.

i. /ui/ in bui

For /ui/ in bui, the average F1 ROC for the KpA speakers is bigger, suggesting that it was produced with more diphthongal movement than Ach. However, no significant differences were found in the average F1 and F2 ROCs between both sets of speakers (F1: t(58)=1.18, p=0.121; F2: t(58)=0.31, p=0.379). This is apparent in Fig.9 which shows a similar trajectory for the diphthong produced by both Ach and KpA speakers.

ii. /ai/ in hei

A larger average F1 ROC for /ai/ in hei by the Ach speakers indicates that it was produced with a greater diphthongal movement compared to KpA. Significant differences were found between the average ROCs for F1 and F2 (F1: t(55)=7.22, p<.0001; F2: t(55)=5.87, p<.0001). This indicates that it was produced differently by both informants. The movement of /ai/ by Ach and KpA can be seen in Fig.10. The onset of the diphthong for the KpA speakers is more back approximating /o/ suggesting a realization closer to /oi/.

Fig.9: Trajectory of the diphthong in ‘bui’ by the Ach and KpA speakers

Fig.10: Trajectory of the diphthong in ‘hei’ by the Ach and KpA speakers

TABLE 3
Average F1 and F2 ROC values for rising diphthongs

<table>
<thead>
<tr>
<th>Target Word</th>
<th>Diphthong</th>
<th>Ach Informants</th>
<th>KpA Informants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>F1 ROC (Hz/sec)</td>
<td>F2 ROC (Hz/sec)</td>
</tr>
<tr>
<td>bui</td>
<td>/ui/</td>
<td>6 (407)</td>
<td>6891 (2406)</td>
</tr>
<tr>
<td>hei</td>
<td>/ai/</td>
<td>-953 (476)</td>
<td>4360 (1207)</td>
</tr>
<tr>
<td>bhöi</td>
<td>/oi/</td>
<td>-10 (363)</td>
<td>5810 (2107)</td>
</tr>
<tr>
<td>lagöina</td>
<td>/ai/</td>
<td>-1562 (848)</td>
<td>7373 (2044)</td>
</tr>
<tr>
<td>poih</td>
<td>/ai/</td>
<td>-1302 (1217)</td>
<td>5188 (3276)</td>
</tr>
<tr>
<td>jai</td>
<td>/ai/</td>
<td>-1643 (927)</td>
<td>2985 (924)</td>
</tr>
</tbody>
</table>

*Standard deviations in parentheses
iii. /oi/ in b hôi

The smaller average F1 ROC of /oi/ in b hôi by the Ach indicates that it was produced with a lesser movement compared to KpA. However, no significant differences were found between the average F1 and F2 ROCs of Ach and KpA (F1: t(58)=3.09, p=0.002; F2: t(58)=1.28, p=0.103). This can be seen in the similar trajectories of this diphthong by both the informants in Fig.11.

Fig.11: Trajectory of the diphthong in ‘b hôi’ by the Ach and KpA speakers

Since auditorily, hei was pronounced closer to hôi by the KpA speakers, the independent samples t-tests were conducted to compare the average F1 and F2 ROCs of /oi/ in hôi and b hôi by this set of speakers. The results showed no significant differences (F1: t(58)=2.68, p=0.005; F2: t(58)=0.4, p=0.345).

iv. /ʌi/ in lagöina

Based on the average F1 ROC value of Ach /ʌi/ in lagöina, it was produced with a greater diphthongal movement compared to KpA. A significant difference was found between the average F1 ROCs (t(58)=5.78, p<0.0001), but not between the average F2 ROCs (t(58)=1.82, p=0.037). This is also reflected in their trajectories in Fig.12, which also show that KpA /ʌi/ starts at a more back position approximating /ɔ/, and ends at a position close to /e/, suggesting a production of a diphthong closer to /œ/.

Fig.12: Trajectory of the diphthong in ‘lagöina’ by the Ach and KpA speakers

v. /ɔi/ in poih

Ach /ɔi/ in poih has larger average F1 and F2 ROCs as compared to KpA, suggesting that Ach /ɔi/ was produced with more diphthongal movement. However, no significant differences were found between the average F1 and F2 ROCs (F1: t(58)=3.84, p=0.0002; F2: t(58)=3.04, p=0.002). Fig.13 further illustrates that the offset of Ach /ɔi/ was produced closer to /ɔǝ/ as its trajectory moves towards the centre of the vowel space instead of to the front position. The KpA /ɔi/ is also seen to be moving from the low back position towards the centre of the vowel space, indicating a realization closer to /œ/. 

Fig.13: Trajectory of the diphthong in ‘poih’ by the Ach and KpA speakers
vi. /ai/ in jai

No significant differences were found between the average F1 and F2 ROCs for Ach and KpA (F1: t(58)=0.03, p=0.488; F2: t(58)=1.14, p=0.130). Both sets of speakers appeared to produce the diphthong in the word jai similarly. This can be seen in the trajectory of the diphthong produced by both group of speakers in Fig.14.

Fig.14: Trajectory of the diphthong in jai by the Ach and KpA speakers

**DISCUSSION**

Based on Asyik’s inventory of 12 Acehnese diphthongs, it appeared that not all were produced as expected by the Ach speakers. These included the possible monophthongisation of /ɛə/, and the diphthongs /ɔə/ and /ɔə/ moving to high back positions rather than to the centre of the vowel space. More changes appeared in the vowels produced by the KpA speakers. Based on the vowels produced by the KpA speakers, only three diphthongs seemed to be maintained, which were /ui/, /oi/ and /ai/. Five appeared to be realized differently than expected based on Asyik’s inventory and dictionary entries. The diphthongs in the words dhöe and toe were realized as /ɔo/, whilst the one in the word hei was realized as /oi/. The diphthong in the word lagöina was realized as /ɔe/ and the one in poih as /oe/. Another four diphthongs in Asyik’s inventory appeared to be produced as long monophthongs of the onset segment. These were /iә/, which was realized as /iː/; /uә/ as /uː/; /œә/ as /œː/; and /ɛә/ which was produced closer to as /ɛː/.

There is a possibility that the KpA speakers have been influenced by the local Kedah dialect and Standard Malay. There are four diphthongs in the Kedah dialect, which are /ai/, /au/, /oi/ and /ui/ (Asmah, 1977, 1993; Ismail et al., 2002):

1. /ai/ such as in sigai (to hit on the head)
2. /au/ such as in bicau (noisy, clamorous)
3. /oi/ such as in boroi (pot-bellied, having a big stomach)
4. /ui/ such as in lebui (very ripe) (Ismail et al., 2002, pp. 52-292)
The first three diphthongs are also used in the Standard Malay (Asmah, 1977, 1993; Teoh, 1994), as in the following:

1. /ai/ such as in pakai (to wear)
2. /au/ such as in kerbau (buffalo)
3. /oi/ such as in sepoi (blowing softly)

(Teoh, 1994, pp. 23-25)

This may explain the uses of /ui/, /oi/ and /ai/ by the KpA speakers which are still maintained as these three diphthongs are also present in the Kedah dialect and Standard Malay. Moreover, the absence of the centering diphthongs in both the Kedah dialect and Standard Malay might also explain why the KpA speakers did not produce these diphthongs. The Ach speakers in this study also produced some of the centering diphthongs differently, such as the monophthongisation of /εə/ and the movement of diphthongs /ʌə/ and /ɔə/ to high back positions, and this may be due to the influence from Bahasa Indonesia. Similar to Standard Malay, Bahasa Indonesia contains three diphthongs, which are /au/, /ai/ and /oi/ (Basuki, 2000; Pusat Pembinaan dan Pengembangan Bahasa, 1993). Some examples are such as in aula (hall), pandai (smart) and amboi (expression of surprise) (Pusat Pembinaan dan Pengembangan Bahasa, 1993, p. 3). As Bahasa Indonesia is the national language that is used in all official domains, Acehnese is also likely to be influenced by it.

CONCLUSION

This paper has extended upon current studies of Acehnese pronunciation by not only comparing the two varieties of Acehnese but also by carrying out an acoustic analysis of the diphthongs in these varieties, and thus, complementing the current auditory descriptions of Acehnese sounds. The study has shown that after over a century of being resettled in Peninsular Malaysia, the continuous contact with the Kedah dialect and Standard Malay may have had an effect on the variety of Acehnese spoken in KpA. At the same time, it also appeared that there was a trend with the centering diphthongs being produced differently by both sets of speakers. One of the implications of this study is that the acoustic analysis of the diphthongs indicates that there have been sound shifts in both varieties of Acehnese. For example, diphthongs becoming monophthongs or shifting vowel positions such as in the case of the centering diphthongs. Another implication is that there appears to be a will to preserve the Acehnese language in KpA despite it being a minority language in Malaysia (see Yusuf et al., 2013). While the ROC measurements suggested some changes in the production of Acehnese diphthongs by the Ach and KpA speakers, future research is necessary to examine the use of diphthongs in a much bigger sample of words and speakers, as well as in different speaking contexts. The influences of the Kedah dialect and Standard Malay on the Acehnese variety spoken in KpA, and Bahasa Indonesia on Ach also need to be pursued.
REFERENCES


### APPENDIX

#### THE TARGET WORDS USED TO ELICIT THE VOWELS

<table>
<thead>
<tr>
<th>Target Word</th>
<th>Diphthong</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>tiep</td>
<td>/iə/</td>
<td>every, each</td>
</tr>
<tr>
<td>beuet</td>
<td>/ɯə/</td>
<td>study, learn</td>
</tr>
<tr>
<td>buet</td>
<td>/uə/</td>
<td>work, job; action</td>
</tr>
<tr>
<td>kée</td>
<td>/ɛə/</td>
<td>I, me, mine (informal, impolite form)</td>
</tr>
<tr>
<td>dhōe</td>
<td>/ʌə/</td>
<td>clogged up</td>
</tr>
<tr>
<td>toe</td>
<td>/ɔə/</td>
<td>near</td>
</tr>
<tr>
<td>bui</td>
<td>/ui/</td>
<td>pig</td>
</tr>
<tr>
<td>hei</td>
<td>/əi/</td>
<td>to call</td>
</tr>
<tr>
<td>bhōi</td>
<td>/oi/</td>
<td>sponge cake</td>
</tr>
<tr>
<td>lagōina</td>
<td>/ʌi/</td>
<td>very</td>
</tr>
<tr>
<td>poih</td>
<td>/ɔi/</td>
<td>mail, post</td>
</tr>
<tr>
<td>jai</td>
<td>/ai/</td>
<td>many, much</td>
</tr>
</tbody>
</table>