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Contrastive Analysis English Vowel Produced by Mandailing Speakers

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Abstract. This study examines the acoustic production of English vowel contrasts by native Mandailing speakers through a sociophonetic lens, exploring how first-language background and gender shape pronunciation patterns. Data were collected via a reading task involving targeted English vowel pairs (/ɪ–iː/, /ʊ–uː/, /æ–e/, and /ʌ–uː/), which were recorded and acoustically analyzed using Praat software to measure first (F1) and second (F2) formant frequencies alongside vowel duration. The results demonstrate that while Mandailing speakers recognize distinct English vowel categories and attempt to separate them, they exhibit restricted vowel space and overlapping acoustic distributions compared to native standards. Notably, the male participant displayed reduced acoustic distance in tongue placement for front vowels and inverted duration patterns for back vowels. Conversely, the female speaker maintained more native-like vowel quality distinctions but showed reliance on adjusted temporal boundaries. These structured variations confirm that unfamiliar target language categories are dynamically integrated into the speaker's native phonological framework. Ultimately, the study highlights how entrenched regional speech practices and social variables actively systematicize non-native phonetic execution.

Keywords: Mandailing; Phonology; Praat; Sociophonetics; Vowel Contrasts.

1. INTRODUCTION

English has become an international language used in various fields such as education, technology, communication, and the workplace. In Indonesia, English is studied as a foreign language (English as a Foreign Language/EFL), so the process of mastering it cannot be separated from the influence of the speaker's first language (or mother tongue) (Kurniawan & Thren, 2024). Pronunciation is a key part of speaking because how words are pronounced affects how clearly people understand each other. Pronunciation consists of several aspects, and vowels are considered one of the most difficult elements for second language learners of English (AbdAlgane & Idris, 2020). This is because the vowel system in English is more complicated compared to the vowel systems in many languages spoken in Indonesia. English has different vowel sounds that are created based on where the tongue is placed, how high the tongue is, and how long the vowel is held. Because of Indonesia's complex sociocultural environment, most people are able to learn and use at least two languages such as their regional or local language and Indonesian as the national language (Suhery et al., 2024). In contrast, many regional languages in Indonesia have simpler systems for their vowels (Widagsa & Putro, 2018). In phonetic and phonological studies, the influence of the first language is often evident in how speakers produce English sounds, particularly vowel sounds that have a different phonological system from their native language. This phenomenon is a key topic in second language acquisition research because it demonstrates how the sound system of the first language influences the production of sounds in the target language.

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The production of English vowels by Indonesian speakers has been the focus of various studies because English has a more complex vowel inventory than regional languages or Indonesian (Masykar et al., 2022). English features a number of vowel contrasts, such as /iː/ and /ɪ/, /æ/ and /ɛ/, or /uː/ and /ʊ/, which are not always found in the vowel systems of Indonesian or other regional languages. As a consequence, Indonesian speakers often struggle to maintain the phonetic distinctions between these vowel pairs, resulting in pronunciation variations influenced by their first language (Widodo et al., 2023). These variations not only reflect the process of second language acquisition but also reveal the relationship between speakers' linguistic identity and their social background.

According to Topsakal (2024), Praat is software used to analyze speech sounds, such as pitch, frequency, intensity, duration, and sound wave visualization. In the field of acoustic phonetics, vowel quality can be analyzed through formant frequencies, especially the first formant (F1) and the second formant (F2). F1 is related to the height of the tongue position, while F2 is related to the front and back position of the tongue during vowel production. By measuring these formants, researchers can describe vowel space objectively and quantitatively. Praat helps researchers analyze these acoustic characteristics more accurately and systematically, making F1 and F2 analysis one of the main methods used in sociophonetic studies to identify sound variations influenced by linguistic and social factors (Gunjawate et al., 2018).

One relevant approach to examining this phenomenon is sociophonetics. Strelluf (2023) states in its book that, Sociophonetics is the study that connects sociolinguistics and phonetics, focusing on how social factors influence the way people use sounds in speech. This study not only examines sound as a linguistic phenomenon but also relates it to social identity, such as gender, age, ethnicity, language community, and the speaker's language experience. In the context of this research, sociophonetics is used to understand how Mandailing speakers produce English vowels and whether there are differences in acoustic characteristics between male and female speakers. This analysis is important because previous research has shown that gender can affect the size of the vocal tract and result in different formant values. Studies in sociophonetics show that different regional languages influence how English is spoken. Yusuf et al. (2024) showed that the vowels in English spoken by people in Indonesia differ based on their gender and their language background. In addition, Damanik et al. (2023) mentioned that Indonesian learners often struggle with correctly producing English vowel sounds because some English vowel sounds are not present in their native language.

The impact of mother tongue influence is one of the key concepts in research on second language phonological acquisition. This theory explains that the first language shapes the perception and production of sounds from the earliest stages of language acquisition, thereby influencing a speaker's ability to produce sounds in a foreign language (Johnson & Hume, 2024). When Mandailing speakers learn English, the sound system they have mastered since childhood can serve as a foundation for producing English sounds. Therefore, the variations in English vowel production that emerge not only reflect the speakers' English proficiency but also reveal the phonological traces of Mandailing as their mother tongue.

Based on the above description, the research question in this study are:

a. How are English vowel contrasts produced by native Mandailing speakers based on F1 and F2 formant values analyzed using Praat?
b. What sociophonetic variations are observed in the acoustic production of English vowel contrasts by Native Mandailing speakers?

To answer these questions, the objectives of this study are to describe and analyze the production of English vowel contrasts by native Mandailing speakers based on F1 and F2 formant values using Praat, and to identify the influence of the Mandailing native language through a sociophonetic approach.

2. LITERATURE REVIEW

Previous research has been conducted on the production of English vowels by Indonesian speakers. One such study was conducted by Kurniawan et al. (2022), who analyzed English vowels produced by Indonesian speakers using Praat. The study measured the F1 and F2 values of several English vowels and compared them with data from American English speakers. The results showed that several vowels, particularly /æ/ and /ɑ/, differed significantly from the standards of native speakers. This study confirms that phonetic and phonemic factors have a significant influence on the production of English vowels by Indonesian speakers.

Another study was conducted by Azzahra et al. (2024), which compared the formants of English vowels between native and non-native speakers using Praat. The study focused on measuring F1 to examine differences in the acoustic characteristics of English monophthong vowels. The findings indicate a fairly clear variation in formant patterns between the native and non-native speaker groups, thus supporting the assumption that first-language background influences the production of English vowels.

Subsequent research in the field of sociophonetics was conducted by Stanford et al. (2021), who discussed the development of automated vocal analysis in sociophonetic research. This

study confirms that formant analysis remains a key parameter in the study of vocal variation because it can quantitatively describe phonetic differences. This study demonstrates how vocal measurements can be used to link sound variation to social factors and speaker identity.

Although various studies on English vowels have been conducted, there are several research gaps that still need to be explored. First, most previous studies have focused on Indonesian speakers in general without considering specific ethnolinguistic backgrounds. Second, research specifically examining Mandailing speakers as an ethnic and linguistic group remains very limited, particularly in the context of English vowel production. Third, previous research has mostly compared native and non-native speakers, whereas studies linking sociophonetic theory, and the influence of the mother tongue on English vowel production by Mandailing speakers are still rare. Fourth, the use of data from male and female Mandailing speakers to examine acoustic variations based on gender has also not been widely conducted.

Based on this research gap, this study offers a novel contribution in the form of an analysis of the production of English vowel contrasts by native speakers of Mandailing using a sociophonetic approach. This study not only measures the F1 and F2 formant values using Praat software but also links these measurement results to the influence of the Mandailing native language on English vowel production. Additionally, this study involves both male and female speakers, thereby providing insights into phonetic variations based on gender within the Mandailing-speaking community.

In academic terms, this study is expected to contribute to research on acoustic phonetics and sociophonetics in Indonesia, particularly regarding the relationship between regional languages and English as a foreign language. The findings may also serve as a reference for English language teachers in understanding the pronunciation difficulties experienced by Mandailing speakers, thereby enabling them to adapt pronunciation teaching strategies to the phonological characteristics of their students' native languages.

3. RESEARCH METHOD

Research Design

This study used a qualitative approach to examine how Mandailing speakers produce contrasts between English vowels. According to John W. Creswell (2014) explains that qualitative research is about understanding and interpreting social and language-related events by closely observing and analyzing them in detail. This study used qualitative phonological analysis to look at how speakers of Mandailing produce contrasts between English vowels and how their native language's sound system affects their English pronunciation. The study was

also approached from a sociophonetic perspective, which combines phonetic analysis with social and linguistic factors in speech production. According to Paul Foulkes and Gerard Docherty (2006), sociophonetics examines how speech variation is influenced by speakers' linguistic backgrounds, habitual speech patterns, and social experiences. In this study, the sociophonetic approach was used to analyze how native Mandailing speakers produce English vowel contrasts and how their pronunciation patterns are reflected acoustically through F1, F2, and vowel duration measurements.

Data Collection Technique

The data were gathered using a pronunciation activity where participants were asked to read certain English words that included specific vowel contrasts like /iː/ versus /ɪ/, /uː/ versus /ʊ/, and /e/ versus /æ/. The participants' speech was recorded with a digital audio device in a quiet place to make sure the sound was clear and easy to understand. The speech recordings were analyzed using Praat to look at how vowels were produced by measuring their formant frequencies and durations.

Data Analysis Technique

The data that was recorded were analyzed with Praat, a software program for phonetic analysis created by Paul Boersma and David Weenink, which is used to study speech sounds. Praat was used to observe and measure how vowels are produced by analyzing sound waves, spectrograms, and formants. The analysis looked at how the participants spoke, paying attention to the differences in vowel sounds, the length of the vowels, and any errors in how the vowels were pronounced. The results were analyzed using a sociophonetic method to look at how the Mandailing sound system affects the way English vowels are produced. The study looked at how a person's first language affects the way they pronounce words when speaking a second language.

4. RESULT AND DISCUSSION

Result

This section presents the acoustic measurements of the English vowel contrasts /iː–ɪ/, /æ–ɛ/, and /uː–ʊ/ produced by the participants. The analysis was conducted using Praat software to obtain the first formant (F1) and second formant (F2) values. The findings are divided into two parts, the productions of the Mandailing speakers and the productions of the native English speaker.

Mandailing Speaker's

Table 1. Formants of Male Participants.

Participant	Word	F1	F2	Duration
Male (Mandailing)	| /ɪ/ | ship |	1288.32 Hz	2461.47 Hz	0.501
	| /iː/ | sheep |	1374.32 Hz	2328.88 Hz	0.7
	| /ʊ/ | full |	1020.47 Hz	1851.96 Hz	0.614
	| /uː/ | fool |	1023.51 Hz	2102.40 Hz	0.44
	| /æ/ | bad |	1092.63 Hz	2149.66 Hz	0.548
	| /e/ | bed |	1369.62 Hz	1927.68 Hz	0.26
	| /ʌ/ | cut |	1150.47 Hz	2310.59 Hz	0.591
	| /ɑː/ | cart |	949.37 Hz	1971.67 Hz	0.385

Table 1 shows the F1, F2, and duration values of English vowels produced by the male Mandailing speaker. The results indicate that the speaker was generally able to produce different English vowel categories, although some vowel contrasts showed only small acoustic differences. For the high front vowels, /ɪ/ in *ship* and /iː/ in *sheep* had relatively similar F1 and F2 values. The vowel /iː/ showed a longer duration (0.700 s) than /ɪ/ (0.501 s), which is consistent with the distinction between long and short vowels in English. However, the similarity in formant values suggests that the speaker may not fully distinguish these two vowels in terms of tongue position.

For the back vowels, /ʊ/ in *full* and /uː/ in *fool* displayed almost identical F1 values (1020.47 Hz and 1023.51 Hz). However, /uː/ had a higher F2 value than /ʊ/, indicating a slightly different tongue position. The duration values also varied, with /ʊ/ being longer than /uː/, which differs from the typical pattern found in native English speech where /uː/ is usually longer.

The vowels /æ/ in *bad* and /e/ in *bed* showed noticeable differences in both F1 and F2 values. The vowel /e/ had a higher F1 value, while /æ/ had a higher F2 value. These findings suggest that the speaker produced these vowels as separate categories, although the acoustic distance between them was not as large as expected in native English pronunciation.

For the central and low vowels, /ʌ/ in *cut* and /ɑː/ in *cart* also showed different formant patterns. The vowel /ʌ/ had higher F1 and F2 values than /ɑː/, indicating a more fronted and lower tongue position. In addition, /ʌ/ was produced with a longer duration than /ɑː/. These differences demonstrate that the speaker was able to distinguish the two vowels acoustically, although further comparison with the native speaker data is needed to evaluate the accuracy of the production.

Table 2. Formants of Female Participant.

Participant	Word	F1	F2	Duration
Female (Mandailing)	| /ɪ/ | ship |	1309.51 Hz	2310.56 Hz	0.992
	| /iː/ | sheep |	1402.88 Hz	2719.94 Hz	0.831
	| /ʊ/ | full |	950.64 Hz	1846.38 Hz	0.691
	| /uː/ | fool |	877.53 Hz	1619.38 Hz	0.686
	| /æ/ | bad |	738.51 Hz	2292.56 Hz	0.581
	| /e/ | bed |	594.48 Hz	1943.29 Hz	0.451
	| /ʌ/ | cut |	851.91 Hz	1780.366 Hz	0.384
	| /ɑː/ | cart |	1088.60 Hz	1990.10 Hz	0.701

Table 2 presents the F1, F2, and duration values of English vowels produced by the female Mandailing speaker. The results show that the speaker produced distinguishable vowel categories across the target vowel contrasts, although some vowels displayed acoustic patterns that may differ from native English pronunciation.

For the front vowel contrast, /ɪ/ in *ship* and /iː/ in *sheep* showed differences in both F1 and F2 values. The vowel /iː/ had a higher F2 value (2719.94 Hz) than /ɪ/ (2310.56 Hz), indicating a more front tongue position. In addition, /ɪ/ was produced with a slightly longer duration (0.992 s) than /iː/ (0.831 s). This finding suggests that the speaker distinguished the two vowels acoustically, although the duration pattern differs from the typical English distinction in which /iː/ is generally longer.

For the back vowel contrast, /ʊ/ in *full* and /uː/ in *fool* showed differences in both F1 and F2 values. The vowel /uː/ had lower F1 and F2 values, indicating a higher and more back tongue position than /ʊ/. However, the duration values were almost identical, with 0.691 s for /ʊ/ and 0.686 s for /uː*. This suggests that the speaker relied more on vowel quality than vowel length to distinguish these two sounds.The vowels /æ/ in *bad* and /e/ in *bed* also showed clear acoustic differences. The vowel /æ/ had higher F1 and F2 values than /e/, indicating a lower and more front tongue position. These differences demonstrate that the speaker was able to maintain the contrast between the two vowel categories.

For the vowel pair /ʌ/ in *cut* and /ɑː/ in *cart*, noticeable differences were found in both formant values and duration. The vowel /ɑː/ showed higher F1 and F2 values and a considerably longer duration (0.701 s) than /ʌ/ (0.384 s). These findings indicate that the female speaker produced the two vowels as separate categories and showed a clear distinction between the short and long vowel sounds.

Native Speaker's

Table 3. Formants of Male Native Speaker.

Participant	Word	F1	F2	Duration
Male	| /ɪ/ | ship |	1304.91 Hz	2132.41 Hz	0.5
	| /iː/ | sheep |	1599.47 Hz	2712.83 Hz	0.48
	| /ʊ/ | full |	1040.15 Hz	2146.27 Hz	1.0
	| /uː/ | fool |	697.26 Hz	2257.78 Hz	0.68
	| /æ/ | bad |	997.69 Hz	1885.65 Hz	0.68
	| /e/ | bed |	1274.05 Hz	2100.49 Hz	0.46
	| /ʌ/ | cut |	1332.86 Hz	2029.00 Hz	0.6
	| /ɑː/ | cart |	1420.23 Hz	2139.96 Hz	0.58

For the vowel /ɪ/ in *ship*, the speaker produced an F1 value of 1304.91 Hz and an F2 value of 2132.41 Hz, with a duration of 0.50 seconds. The vowel /iː/ in *sheep* showed higher F1 and F2 values, reaching 1599.47 Hz and 2712.83 Hz respectively, while the duration was 0.48 seconds. These values indicate that the two front vowels occupied different acoustic positions.

The back vowels /ʊ/ in *full* and /uː/ in *fool* also displayed distinct formant values. The vowel /ʊ/ had an F1 value of 1040.15 Hz and an F2 value of 2146.27 Hz, with a duration of 1.00 second. Meanwhile, /uː/ showed a lower F1 value of 697.26 Hz and a slightly higher F2 value of 2257.78 Hz. The duration of /uː/ was measured at 0.68 seconds.

For the vowel pair /æ/ in *bad* and /e/ in *bed*, the speaker produced F1 values of 997.69 Hz and 1274.05 Hz respectively. The F2 values were 1885.65 Hz for /æ/ and 2100.49 Hz for /e/. The durations were 0.68 seconds for /æ/ and 0.46 seconds for /e*. These measurements show that the two vowels were produced with different acoustic characteristics.

The vowels /ʌ/ in *cut* and /ɑː/ in *cart* also exhibited distinct formant patterns. The vowel /ʌ/ had an F1 value of 1332.86 Hz and an F2 value of 2029.00 Hz, while /ɑː/ showed an F1 value of 1420.23 Hz and an F2 value of 2139.96 Hz. The durations of the two vowels were relatively similar, measuring 0.60 and 0.58 seconds respectively.

Table 4. Formants of Female Participant.

Participant	Word	F1	F2	Duration
Female	| /ɪ/ | ship |	1714.10 Hz	2609.09 Hz	0.45
	| /iː/ | sheep |	1184.30 Hz	2299.57 Hz	0.5
	| /ʊ/ | full |	832.86 Hz	1654.94 Hz	0.72
	| /uː/ | fool |	751.49 Hz	1293.94 Hz	0.81
	| /æ/ | bad |	1055.83 Hz	1791.24 Hz	0.37
	| /e/ | bed |	1037.26 Hz	2396.50 Hz	0.67
	| /ʌ/ | cut |	1357.83 Hz	2272.36 Hz	0.6
	| /ɑː/ | cart |	1129.99 Hz	1778.63 Hz	0.69

For the front vowels, /ɪ/ in *ship* had an F1 value of 1714.10 Hz and an F2 value of 2609.09 Hz, with a duration of 0.45 seconds. The vowel /iː/ in *sheep* showed an F1 value of

1184.30 Hz and an F2 value of 2299.57 Hz. The duration of /iː/ was slightly longer at 0.50 seconds. These values indicate different acoustic distributions between the two front vowels.

For the back vowels, /ʊ/ in *full* had an F1 value of 832.86 Hz and an F2 value of 1654.94 Hz, with a duration of 0.72 seconds. The vowel /uː/ in *fool* showed lower formant values, with an F1 of 751.49 Hz and an F2 of 1293.94 Hz. The duration of /uː/ was measured at 0.81 seconds.

The vowel pair /æ/ in *bad* and /e/ in *bed* also displayed different formant values. The vowel /æ/ had an F1 value of 1055.83 Hz and an F2 value of 1791.24 Hz, while /e/ had an F1 value of 1037.26 Hz and an F2 value of 2396.50 Hz. The duration values were 0.37 seconds for /æ/ and 0.67 seconds for /e/.

For the vowels /ʌ/ in *cut* and /ɑː/ in *cart*, the speaker produced an F1 value of 1357.83 Hz and an F2 value of 2272.36 Hz for /ʌ/. The duration was recorded at 0.60 seconds. Meanwhile, /ɑː/ had an F1 value of 1129.99 Hz and an F2 value of 1778.63 Hz, with a duration of 0.69 seconds.

Discussion

Comparison between Male Mandailing Speaker and Male Native Speaker

A contrast between the male Mandailing speaker and the male native speaker shows various similarities and distinctions in the articulation of English vowel contrasts. For the front vowel distinction /ɪ–iː/, both speakers generated distinct vowel classifications. The native speaker exhibited a greater acoustic distinction, especially in F2 values, with /iː/ reaching 2712.83 Hz, while /ɪ/ was at 2132.41 Hz. Conversely, the Mandailing speaker exhibited comparable F2 values (2461.47 Hz for /ɪ/ and 2328.88 Hz for /iː/), indicating a diminished difference in tongue placement.

The native speaker distinctly distinguished the back vowels /ʊ–uː/ using both F1 and F2 measurements. The Mandailing speaker, on the other hand, generated almost the same F1 values (1020.47 Hz and 1023.51 Hz), suggesting that the two vowels had a comparable tongue height position. Additionally, the Mandailing speaker articulated /ʊ/ for a longer period than /uː/, while the native speaker demonstrated a more pronounced difference between the two vowels.

The vowel combination /æ–e/ also exhibited variations among the speakers. While the Mandailing speaker kept distinct categories, the acoustic gap between the vowels was less than that of the native speaker. In a similar manner, regarding /ʌ–ɑː/, the native speaker exhibited more distinct formant patterns, whereas the Mandailing speaker displayed some overlap and an inverted duration pattern.

These results indicate that the male Mandailing speaker could identify the English vowel differences but did not articulate them as clearly as the native speaker. This pattern might indicate the impact of the Mandailing vowel system, which has fewer vowel distinctions compared to English.

Comparison between Female Mandailing Speaker and Female Native Speaker

The analysis of the female Mandailing speaker and the female native speaker shows a distinct pattern. In the front vowel contrast /ɪ–iː/, the Mandailing speaker showed a pronounced difference in F2 values, with /iː/ attaining 2719.94 Hz against 2310.56 Hz for /ɪ/. Notably, this difference was similar to, and in certain ways even greater than, what was seen in the native speaker's output.

Both speakers distinguished the back vowels /ʊ–uː/ by their formant values. Nonetheless, the female Mandailing speaker exhibited almost the same lengths for the two vowels, while the native speaker preserved a more distinct temporal difference. This indicates that the Mandailing speaker depended more on vowel quality rather than vowel length. Both speakers also preserved the distinction between /æ/ and /e/.

Nonetheless, the native speaker showed a greater F2 variation, reflecting a more distinct separation between front vowel types. Regarding the vowel pair /ʌ–ɑː/, both speakers created distinct vowel categories, although the Mandailing speaker demonstrated a higher reliance on duration variations compared to the native speaker.

In general, the female Mandailing speaker seemed to resemble native-like vowel production more than the male Mandailing speaker. The acoustic variations between the female Mandailing speaker and the female native speaker were typically less pronounced than those noted in the male comparison.

How are English Vowel Contrasts Produced by Native Mandailing Speakers Based on F1 and F2 Formant Values Analyzed Using Praat?

According to the acoustic analysis performed with Praat, the findings indicate that the Mandailing speakers were generally capable of producing the target English vowel contrasts, specifically /ɪ–iː/, /ʊ–uː/, /æ–e/, and /ʌ–ɑː/. The F1 and F2 values show that the speakers did not articulate all vowels identically. Rather, every vowel pair exhibited distinct acoustic features, indicating that the participants acknowledged the presence of various vowel categories in English and tried to articulate them individually.

For the vowel pair /ɪ–iː/ in ship and sheep, both Mandailing speakers displayed variations in formant values. The female participant showed a more pronounced distinction, especially in F2 values, indicating a variation in tongue placement between the two vowels.

The male participant likewise produced the vowels in a distinct manner, yet the acoustic distance between them was reduced. This result suggests that while the speakers recognized the difference, the separation was not as pronounced as what is usually observed in native English conversation.

A comparable trend was noted in the creation of /ʊ–uː/ in full and fool. The speakers generated distinct F1 and F2 values for the two vowels, indicating that they tried to preserve the distinction. Nonetheless, the male participant generated almost the same F1 values for both vowels, indicating that the tongue height employed for the two sounds was quite alike. The female participant exhibited a more distinct variation in vowel quality, while the vowel duration stayed nearly unchanged. These results indicate that the contrast existed but was not completely formed.

The vowel pair /æ–e/ in bad and bed displayed more distinct acoustic variations. Both speakers generated unique F1 and F2 values, suggesting varying tongue placements for each vowel. In comparison to the other vowel pairs, this distinction seemed to be upheld more effectively. This indicates that the speakers had a greater ability to acoustically distinguish these vowels.

For the vowel pair /ʌ–ɑː/ in cut and cart, the findings similarly revealed significant variations in both formant values and length. The speakers articulated the two vowels as distinct categories, showing an understanding of the difference. The female participant, specifically, demonstrated a noticeable difference between the vowels in terms of both vowel qualitu and length.

What Sociophonetic Variations Are Observed in the Acoustic Production of English Vowel Contrasts by Native Mandailing Speakers?

The results indicate various sociophonetic differences in how native Mandailing speakers acoustically produce English vowel distinctions. An analysis performed with Praat demonstrated that participants exhibited repeated patterns in their F1, F2, and vowel duration data. Certain English vowel pairs, notably /iː/-/ɪ/ and /e/-/æ/, showed overlapping acoustic manifestations, suggesting a diminished differentiation among vowel categories.

Foulkes and Docherty (2006) assert that sociophonetic variation illustrates the connection between how speech is produced and the linguistic backgrounds of speakers. In this research, it was noted that Mandailing speakers often articulated English vowels with patterns that were sonically similar to their own native vowel system. This inclination is evident in the somewhat restricted vowel space and the lesser distinction made between tense and lax vowels.

The results additionally reveal differences in the length of vowel sounds. Various long vowels in English were articulated with a lesser duration when compared to the typical pronunciation in English, implying that distinctions in vowel length were not consistently preserved. From a sociophonetic viewpoint, these trends illustrate regular speech patterns shaped by the speakers' native language's phonological rules and their physical speaking practices.

Moreover, the persistent similarities in the acoustic properties of the participants' speech signify that the variations in pronunciation are organized rather than haphazard. This research thus endorses the sociophonetic perspective that speech articulation is impacted by linguistic experiences and phonological history, which can be analyzed through quantifiable acoustic characteristics like formant frequencies and vowel length.

5. CONCLUSION

This research finds that speakers of Mandailing exhibit noticeable sociophonetic differences when articulating English vowel distinctions. Utilizing acoustic analysis via Praat, it was observed that various English vowels had overlapping F1 and F2 formant measurements, especially in the pairs /iː/-/ɪ/ and /e/-/æ/. The results further indicated variations in vowel length, with certain long vowels being pronounced with a shorter duration compared to typical English pronunciation. This suggests that the participants did not consistently differentiate English vowel contrasts in an acoustic manner.

From a sociophonetic perspective introduced by Paul Foulkes and Gerard Docherty in 2006, the results indicate that pronunciation trends are intricately linked to the linguistic history and regular speech habits of the speakers. The speakers of Mandailing typically modified unknown English vowel classifications into articulatory forms that were more recognizable within their own native phonological framework. This illustrates that the differences in vowel articulation are methodical instead of coincidental, and that speech production is shaped by prior phonological knowledge and established pronunciation routines.

This research adds to the field of sociophonetics by offering an acoustic examination of English vowel articulation in native speakers of Mandailing, measured through F1, F2, and the duration of vowels. Nonetheless, the research is constrained by the limited participant pool and the narrow range of vowel contrasts that were studied. Subsequent research could incorporate larger participant groups and more diverse sociolinguistic factors to investigate

the impact of various social and linguistic elements on English pronunciation among speakers of regional languages.

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