Investigating the Arabic /f/ Pronunciation: A Comparative Analysis of Acoustic Phonetics

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Abstract
This study aims to understand the mispronunciation of the consonant /f/ in Arabic by Javanese Speakers (JS), Sundanese Speakers (SS) and Batak Speakers (BS). The focus is on the sound /f/ as it can shift to /p/ when spoken by speakers of various L1 languages. Javanese, Sundanese, and Batak were chosen because of their prominence in Indonesia. Using a descriptive-evaluative-comparative approach, the researchers analyzed the pronunciation of /f/ by JS, SS, BS, contrasted with a native speaker (NS), Sheikh Misyari bin Rasyid Al-’Afasi. The research data was in the form of sound recordings of the recitation of nine verses of the Quran with the sound /f/, collected using the listen-record-pay-attention technique and analyzed acoustically through Praat. The findings reveal phonetic interference in pronouncing /f/ at the beginning, middle, and end of words by SS and BS. In JS, it only occurs at the beginning and the end. The absence of sound /f/ in the phonological system of local languages can cause this interference. The implication lies in learning to listen and speak Arabic, helping to design strategies to overcome pronunciation errors when encountering foreign sounds in the learner’s phonological system.

Keywords: Arabic, Phonemes, Interference, Consonants, Labiodental

Abstrak
INTRODUCTION

The diversity of tribes and nations in Indonesia is indeed one of the characteristics that distinguishes Indonesia from many other countries. In addition to ethnic and national diversity, Indonesia is also characterized by vibrant ethnic and linguistic diversity. According to the Language Development and Bookkeeping Agency of the Ministry of Education and Culture (2019), Indonesia has 718 regional languages. This wealth is a valuable and priceless cultural heritage that must be preserved (Peter & Simatupang, 2022). Language is an identity that differentiates one nation from another (Month, 2019). The role of Indonesian as a unified language is vital, but the Indonesian people still need to remember the existence and importance of regional languages. Regional languages have precious cultural values, and even so, it must be acknowledged that progress in the development of Indonesian has brought several changes in people’s communication patterns, especially in areas that rely more on spoken language.

In Indonesia, only nine languages have a script system: Sundanese, Javanese, Batak, Acehnese, Lampung, Malay, Balinese, Bugis and Sasak (Sinaga, 2019). Every act of spoken communication has a phonological word form (Hameau et al., 2021). In daily communication, Indonesian people are used to language contact between Indonesian and regional languages. This language contact often occurs in various contexts within the family, community, and broader social interactions. This phenomenon shows the flexibility and openness of the Indonesian people in communicating, as well as a reflection of this nation’s rich culture and language. However, contact between languages can also be a challenge. A mistake may occur where elements of the regional language are already embedded in the people’s minds, and it can interfere with learning a new language. For example, using sentence structure or pronunciation influenced by regional languages can create misunderstandings in the studied language. This mistake is called interference, caused by a tendency or habit in pronunciation (Thoyib & Hamidah, 2017).

Phonetic interference can occur due to the influence of the mother tongue or other languages that have been mastered (Muzaki & Darmawan, 2022). Simply put, this statement relates to the phenomenon in which the sound production of an L2 (second language) phoneme is influenced by the speaker’s L1 (first language) phonological system. It is common when bilingual or multilingual speakers try to pronounce the sound of a L2 phoneme, not in their L1. According to Flege and Port (1981), speakers’ bilingualism is one of the factors causing phonetic interference. Bilingualism occurs when the speaker’s L1 interacts with the L2 he is studying or acquiring, which then affects the use of the L2. The influence of L1 on learning L2 can be either positive or negative. Positive transfer occurs when the speaker’s L1...
understanding facilitates the use of L2, while negative transfer occurs when the speaker's L1 understanding causes errors, including phonetic interference, in the use of L2. It is the same as what was stated by Sol'ene Hameau et al. (2021), that the mother tongue has an influence when someone learns a foreign or second language.

In a foreign language learning process, this is a problem that teachers often experience. Fahrurrozi (2014) mentions two linguistic problems that are often faced by teachers in language learning, which are called linguistic and non-linguistic or non-linguistic problems. This phonological interference is one of the linguistic problems experienced by students. The importance of foreign language skills by language rules, especially phonology, will make inter-language communication easy to understand and comprehend (Asih et al., 2020). This exciting phenomenon, including in Arabic, has attracted the attention of many researchers.

Al-Hattami (2010) once said that the main difficulty in learning a new language is interference from L1. Phonetic interference, among other things, occurs due to the influence of the L1 phonological system on the pronunciation of L2 phonemes that are not in the speaker's L1. This phenomenon often appears in foreign language learning, including Arabic. The differences in the phonological systems of L1 and L2 that are studied can increase the chances of phonetic interference. In Arabic learning, phonetic interference is one of the linguistic phenomena that hinder listening, speaking, and other skills because mispronunciation of a phoneme can cause ambiguity in meaning and misunderstandings when communicating. Unfortunately, the phonological aspect of Arabic learning receives less attention because learning tends to focus more on reading skills and memorizing vocabulary and grammatical rules. In addition, the learner's lack of mastery of phonological theories is also one of the reasons that needs more attention. However, there is a method and media used in Arabic phoneme pronunciation training using an automatic voice recognition system. Research from Zinah Jaffar Mohammed Ameen and Abdulkareem Abdulrahman Kadhim (2023) states that the Artificial Neural Network (ANN) learning method has an accuracy of 75%. However, unfortunately, this method is still not widely used because few educators know the importance of phoneme pronunciation.

According to research by Rahmatia et al. (2021), the speaker's L1 phonological system is one of the factors that causes phonetic interference in Arabic text reading skills. Arabic phonology has 28 consonants and 6 vowels (Sidran, 2021); it means that Arabic has 34 phonemes overall. The six Arabic vowels consist of three short vowels (/a/, /i/, and /u/) and three long vowels (/aː/, /iː/, and /uː/). As a result, Arabic vowels’ lengths are phonemic to distinguish the meaning of words (Ibrahim et al., 2020). One phonetic interference phenomenon occurs in SS when pronouncing the sound /f/, which becomes the sound /p/. This phenomenon has been widely researched, one of which is by Selviana et al. (2020); this study explains that basically, the Sundanese language and script do not contain the sound /f/, so, naturally, Sundanese people have difficulty pronouncing the sound /f/. JS and BS also experience this phenomenon. It is because JS still needs the phoneme /f/ (Nurtinasari, 2015) as well as BS (Sinaga, 2019). Apart from that, research on the causes of phonological errors was
conducted by Sholihah (2021) and Nawang Wulandari (2020); both studies explained that mother tongue habits influence the foreign or second language being studied.

In Arabic, the place where the sound comes out is called the *makhraj* and is defined as a position where the air is trapped or narrows when speaking (Mahdi in Marlina, 2019). *Makharijul Huruf* produces different pronunciations according to the characteristics of the letters. They are classified into five parts, namely: *al-half* (throat), *al-lisan* (tongue), *asy-syafatain* (lips), *al-jauf* (mouth) and *al-khaisyum* (bridge of the nose) (Fitria & Al Farisi, 2023). This difference in pronunciation characteristics opens the possibility for non-native speakers to make mistakes when pronouncing letters (Ekayanti, 2019). In articulation, there are consonants based on the place of articulation, namely bilabial, labiodental, lamino-alveolar and dorsoventral (Jannah, 2019). The sound /f/ is included in the labiodental sound in fricative consonants (Fadhilah et al., 2020), which means the sound /f/ in the pronunciation of “fa” to the lower lip follows the upper teeth by bringing the lower lip together with the upper teeth. For JS, SS, and BS, this difficulty can be viewed from a linguistic point of view due to phonological differences between regional languages and Arabic; there are also some phonetics in regional languages that are not found in Arabic.

Based on these problems, the researchers conducted a comparative study of JS, SS and BS based on acoustic-phonetic studies. Acoustic phonetic studies aim to understand various aspects of language sounds produced and received by human speech organs, including how language sounds travel through the air and are then perceived by human hearing (Muslich, 2018). This research is intended to reveal the realization of phonetic interference of JS, SS, and BS in the pronunciation of voiceless fricative labiodental consonants /f/ in Arabic, which might occur due to their L1 interference. Because this research requires acoustic analysis, the researcher will use the help of Praat software to analyze the pronunciation of NS, JS, SS and BS.

Hopefully, this research can provide deeper insight into learning and teaching Arabic phonetics, especially regarding the sound /f/, to significantly contribute to understanding Arabic phonetics in learning a foreign language. In addition, it is hoped that this research will produce solid and relevant empirical data to support further research in Arabic acoustic phonetics, opening the door for a broader exploration of phonetic aspects in Arabic. The information obtained from this research can become a solid foundation for developing more effective Arabic learning methods, with particular emphasis on teaching sounds that may have a higher difficulty level, such as the sound /f/. Thus, this research will not only serve as an academic contribution but can also positively impact the practice of teaching Arabic in various learning environments.

**METHOD**

**Research Design**

This descriptive-evaluative-comparative research uses a content analysis research design to describe and evaluate the pronunciation of the consonant /f/ by three groups of speakers, namely JS, SS, and BS. This analysis suits various data (Lindgren et al., 2020). Therefore, the researcher uses content analysis to compare
with the consonant /f/ of an NS utterance: Sheikh Misyari bin Rasyid Al-‘Afasi, who is a qari, hafiz, and imam from Kuwait.

**Data Collection Technique**

Sampling methods are critical to designing quality research. Through this research, the researchers use a purposive sampling technique, which is selecting samples based on specific considerations and assessments (Berndt, 2020). In this case, the researchers choose sources from indigenous tribes. Furthermore, the data collection method is implemented through observation and note-taking techniques. Researchers record the sounds of each group, JS, SS and BS, when reading nine verses from the Quran containing the consonant /f/. The recorded data is processed using Praat software version 6.2.13 to assist researchers in assessing and measuring the accuracy of the data collected.

**Data Analysis Technique**

The results of the analysis obtained through Praat from the three groups of speakers are then compared with the consonant /f/ pronunciation by the NS. This comparison aims to understand the differences and similarities in pronouncing the consonant /f/ between speakers of regional languages in Indonesia and NS with different cultural backgrounds. Thus, this research is expected to provide insight into the phonetic characteristics and possible phonetic interference in the pronunciation of the consonant /f/ in various groups of speakers and compare it with the pronunciation standards shown by NS as a foreign language speaker.

**RESULTS**

The phonetic interpretation of the phoneme /f/ was analyzed by looking for three native speakers from the Javanese, Sundanese and Batak background. In addition, the researcher looked for several readings of the holy verse of the Quran, Juz 30, recited by Sheikh Misyari bin Rasyid Al-‘Afasi on YouTube. The first analysis process was carried out by analyzing the findings of Sheikh Misyari’s reading in Surah Al-Infiṭār Verse 3 on the word Fujjirat, then in Surah ‘Abasa verse 14 on the word Marfūʿatīn and Surah ‘Abasa verse 13 on the word Ṣuḥufīn. These three words describe the position of the /f/ phoneme at the beginning of the word Fujjirat, in the middle of the word Marfūʿa and at the end of the word shuhufi, as in the following table:

<table>
<thead>
<tr>
<th>Early</th>
<th>Middle</th>
<th>Late</th>
</tr>
</thead>
<tbody>
<tr>
<td>﴿ذَا ﷲۡوَ ﷲۡﻟۡﺒِﺤَﺎرُ ﷲۡﻓُﺠِّۡﺮَتۡ ﷲۡﻣﱠﺮْﻓُﻮﻋَﺔٍ ﷲۡﻣﱡﻄَهﱠﺮَةٍ ﷲۡﺣُﻒٍ ﷲۡﻣﱡﻜَﺮﱠمَﺔٍ﴾</td>
<td>﴿وَاَذَا ﷲۡلِيِّحَازُ ﷲۡفَجِّۡﺮَت﴾</td>
<td>﴿مُﺮْفَوعَةٍ مَّطَهَّرَةٍ مُّكَرَّمَة﴾</td>
</tr>
</tbody>
</table>

Analysis of these three words used the Praat software version 6.2.13. This application helps researchers see the spectrogram produced from recorded sound/audio. After the researcher got the spectrogram results of these three words, the researcher asked each regional speaker to read and record the same verse according to the table. The results found from the phonological analysis are shown in the following figure:
Phoneme Position /f/ | NS (Misyari Rashid) | Sundanese speaker (Nursidiq Muzahidin Taufiq) | Batak speaker (Andhika Mulia Daulay) | Javanese speaker (Ahga)
---|---|---|---|---
Initial Sound | Figure 1 | Figure 2 | Figure 3 | Figure 4
Medial Sound | Figure 5 | Figure 6 | Figure 7 | Figure 8
Final Sound | Figure 9 | Figure 10 | Figure 11 | Figure 12

**Figure 1. Visualization of the annotation of the pronunciation of the phoneme /f/ in the word فُجِّرَتْ at the beginning of the word by the NS**

Figure 1 shows the spectrogram of the phoneme pronunciation /f/ by Arabic NS. The wave generated from the phoneme /f/ indicates a labiodental sound. Labio-dental is a sound whose articulation involves the lips (Nasaruddin, 2017). In the pronunciation of the phoneme /f/, the lower lip follows the upper teeth so that when pronouncing the part, it sticks and makes the resulting wave of the pronunciation of the phoneme /f/ light at the beginning of the pronunciation (Marlina, 2019). In pronunciation, the phoneme /f/ at the beginning of a word will be pronounced louder than when the phoneme /f/ is in the middle or at the end of a word.

**Figure 2. Visualization of the annotation of the pronunciation of the phoneme /f/ by SS**
Figure 2 presents an annotation of the sound waves of the pronunciation of the phoneme /f/ by Sundanese speakers. The waves produced from the phoneme /f/ in Figure 2 are thinner and have a straightness in the waves. It is contrary to the nature of the phoneme /f/, which should be pronounced flowing or rakhwah so that the resulting waves are not interrupted (Hidayat, 2022).

Figure 3. Visualization of the annotation of the pronunciation of the phoneme /f/ by BS

Figure 3 presents an annotation of sound waves for BS' pronunciation of the phoneme /f/. The waves generated from the phoneme /f/ in Figure 3 are thick and have a tenuous wave spectrogram. This is contrary to the nature of the phoneme /f/, which should be pronounced flowing or rakhwah (Hidayat, 2022).

Figure 4. Visualization of the annotation of the pronunciation of the phoneme /f/ by JS
Figure 4 presents an annotation of sound waves for JS' pronunciation of the phoneme /f/. The waves generated from the phoneme /f/ by JS are thinner at the end of their articulation compared to Arabic NS.

**Figure 5. Annotation visualization of the pronunciation of phoneme /f/ in the word مرفوعة in the middle of the word by NS**

Figure 5 shows that Arabic NS pronounces the sound waves in phonemes /f/ by describing the phoneme /f/, whose pronunciation is thin and light (Marlina, 2019). In pronouncing the phoneme /f/ in the middle of a word, it will be pronounced thin and light compared to when the phoneme /f/ is at the beginning of a word. It is because the phoneme /f/ is a shifting consonant, so the sound produced is not tightly packed together, and there is also a vibration when it is pronounced, causing the most characteristic found in phoneme /f/ to be more pronounced. The results of the analysis of the phoneme /f/ pronunciation by SS, BS, and JS are presented in the next spectrogram.

**Figure 6. Visualization of the annotation of the pronunciation of the phoneme /f/ by SS**
Figure 6 presents an annotation of the sound waves of the pronunciation of the phoneme /f/ by SS. The waves generated from the phoneme /f/ in Figure 6 at the beginning of the articulation tend to be louder than those of the Arabic NS, which causes the waves in the picture to be very thick compared to the Arabic speaker.

Figure 7. Visualization of the annotation of the pronunciation of the phoneme /f/ by BS

Figure 7 annotates sound waves for BS's pronunciation of the phoneme /f/. The waves generated from the phoneme /f/ in Figure 7 tend to be pronounced loudly at the end of the articulation, so the waves look thicker than those confirmed by Arabic NS.

Figure 8. Visualization of the annotation of the pronunciation of the phoneme /f/ by JS
Figure 8 annotates sound waves for JS phoneme /f/ pronunciation. The waves generated from the phoneme /f/ by the JS are by the nature of the phoneme /f/, which is pronounced by Arabic NS.

Figure 9. Visualization of the annotation of the pronunciation of the phoneme /f/ in the word ﻓِﻲ ﺻُﺤُﻒٍ at the end of the word by NS

Figure 9 shows that Arabic NS pronounces the sound waves in phonemes /f/ by the description of the phoneme /f/, whose pronunciation is thin and light (Marlina, 2019). In pronunciation, the phoneme /f/ at the end of a word is pronounced thinner than when the phoneme /f/ is at the beginning or in the middle of a word. Then, the results of the analysis of the pronunciation of the phoneme /f/ by SS, BS, and JS are presented in the next spectrogram.

Figure 10. Visualization of the annotation of the pronunciation of the phoneme /f/ by SS
Figure 10 presents an annotation of sound waves for SS’s pronunciation of the phoneme /f/. The waves generated from the phoneme /f/ by SS are thick at the end of the articulation.

**Figure 11. Visual annotation of pronunciation of phoneme /f/ by BS**

Figure 11 presents an annotation of sound waves for BS’ pronunciation of the phoneme /f/. The waves generated from the phoneme /f/ by BS are thick at the end of the articulation.

**Figure 12. Annotation visualization of the pronunciation of the phoneme /f/ by JS**
Figure 12 presents a sound wave annotation for JS' pronunciation of the phoneme /f/. The waves generated from the phoneme /f/ by JS are thicker, and the sound waves are more tenuous than those of the Arabic NS.

DISCUSSION

**Analysis of the Phoneme /f/ at the Beginning of a Word**

In the spectrogram data shown in Figure 1, the Praat application analysis shows that the waves produced from the phoneme /f/ show a labiodental sound in Arabic native speakers. Meanwhile, for the three regional speakers, the results of the data analysis obtained by the researchers showed that the pronunciation of the phoneme /f/ by the Sundanese, Batak and Javanese speakers did not have the correct pronunciation or was slightly closer to the correct pronunciation by the NS. It is because Javanese speakers do not have the phoneme /f/ (Nurtinasari, 2015), as do Batak speakers (Sinaga, 2019) and Sundanese speakers (Ali et al., 2020).

SS’ pronunciation errors lie in shifting the word’s meaning. As for BS, the pronunciation errors are similar to those made by SS. In JS, the error lies in their articulation, which is thinner than NS. This is contrary to the nature of the phoneme /f/, which should be pronounced flowing or rakhhawah so that the resulting wave is unbroken (Hidayat, 2022). It may lead to a change in meaning or loss of meaning of the word (Lathifah et al., 2017). The word *Fujjarat Marfu'atin Šuhufin* has the meaning "to be made to overflow." Then, if there is an error in the pronunciation, there will be the loss of meaning in the word *Fujjarat*.

In general, pronunciation errors in the phoneme /f/ lie in light articulation when pronounced. From this articulation, the phoneme /f/ has a unique characteristic, namely *idzlax*. *Idzlax* is a term for pronouncing letters lightly or quickly because the position of the *makhraj* is on the tip of the tongue or lips (Rusyd, 2019).

**Analysis of the Phoneme /f/ in the Middle of Words**

In the spectrogram data shown in Figure 5, the Praat application analysis shows that in NS, the waves produced from the phoneme /f/ show a thin and light pronunciation. Because the phoneme /f/ is a sliding consonant, the sound produced is not tightly coupled, and there is vibration when pronounced, causing the characteristic of the phoneme /f/ to be more pronounced.
When pronouncing the phoneme /f/ in the middle of a word, only JS do not make phonological errors. In SS, the pronunciation of the phoneme /f/ in the middle of a word tends to be louder than in NS, causing the waves in the image to be very thick. Meanwhile, for BS, the phoneme /f/ pronunciation tends to be thicker at the end of words. It is contrary to the nature of the phoneme /f/, which should be pronounced thin and light when in the middle of a word (Hidayat, 2022). The word Marfūʿatin means "exalted". If there is an error in the pronunciation, it will result in the loss of meaning in the word Marfūʿatin.

**Analysis of the Phoneme /f/ at the End of a Word**

In the spectrogram data shown in Figure 9, the Praat application analysis shows that in NS, the waves produced from the phoneme /f/ show a thin and light pronunciation. In pronunciation, the phoneme /f/ at the end of a word will be pronounced thinner than when the phoneme /f/ is at the beginning or in the middle of a word. Meanwhile, for the three regional speakers, the data analysis obtained by the researchers showed that the pronunciation of the phoneme /f/ by SS, JS, and BS needed to be adjusted.

In SS, the sound wave annotation looks thicker at the end of the articulation. As for JS, the waves produced from the phoneme /f/ by Javanese speakers are thick, and the sound waves are thinner. Meanwhile in BS, the waves produced look thick at the end. It is contrary to the nature of the phoneme /f/, which should be pronounced thinner and lighter at the end of a word (Hidayat, 2022). The word Ṣuḥufi has the meaning "in the books." If there is an error in the pronunciation, it will result in the loss of meaning in the word Ṣuḥufīn.

**CONCLUSION**

The rich language of the Indonesian nation triggers various phonetic interferences. The leading cause is the differences in consonants in each language. In regional languages in Indonesia, only a few languages have a writing system, including Sundanese, Javanese, and Batak tribes. This language system makes it convenient to assume that there is phonetic interference with the /f/ phoneme because these three languages do not have the /f/ phoneme. The results of this research turned out to show similar results. Phonetic interference occurred in the three regional language speakers. In SS and BS, phonetic interference occurs at words’ beginning, middle, and end. Meanwhile, JS only appears at the beginning and end of words. This interference can change the meaning of words, even eliminating the meaning of words in Arabic. This research will likely provide an understanding of phonetic interference. It can help design learning strategies that reduce pronunciation errors when dealing with sounds that do not exist in the phonological system of L1 speakers. Researchers expect that there will be research on more sophisticated learning techniques using digital media and focusing on reducing pronunciation errors that need to be integrated into the educational curriculum to maintain the authenticity and richness of the Indonesian language.

In addition, this phonetic interference analysis can be developed for other sounds and speakers of other regional languages in Indonesia.

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