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PHONOLOGICAL INTERFERENCE IN THE PRONUNCIATION OF INDONESIAN BY ACEHNESE SPEAKERS: A CASE STUDY OF CONSONANT VARIATIONS IN LANGSA

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Abstract

Linguistic issues such as interference and integration frequently arise in multilingual environment, which frequently result in barriers to second language production. This study examines at how language interaction between Acehnese and Indonesian has affected the Indonesian language in Langsa, with a particular emphasis on consonant variations and interference. The objective of this study was to investigate the influence of phonological interference on Acehnese speakers when speaking the Indonesian language, with a specific focus on observing variations in consonant sounds using auditory means. The study conducted a detailed examination of common variances in Indonesian pronunciation among Acehnese speakers. This qualitative research was carried out in Langsa, Aceh Province, involving 40 individuals who are native speakers of Acehnese. The participants consisted of 20 males and 20 females, encompassing a range of ages. The collected data was evaluated using the PRAAT software. The findings revealed that there was interference in pronunciation, particularly in the form of devoicing, which is the absence of vowel resonance. This was observed in the words "[ap. di]" and "[ʤa.wap]." This interference leads to a significant level of devoicing, reaching 90% and 100% respectively. Furthermore, the study revealed phonological interference in words such as "[thə.linga]", "[tə.thap]", and "[a.hat]", with speakers demonstrating devoicing rates of 40%, 40%, and 100% respectively. The findings showed the complex nature of phonological interference in the pronunciation of the Indonesian language by Acehnese speakers. These findings served as a foundation for the development of more effective strategies for acquiring a second language, particularly in diglossic environments like Indonesia.

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INTRODUCTION

Interference and integration are frequently observed linguistic phenomena in multilingual settings. These two linguistic phenomena arise from the interaction between two languages, the first and second. Language contact can have either beneficial or detrimental effects. Interference arises when multilingual individuals exhibit discrepancies between the characteristics of their primary and secondary languages, leading to linguistic inaccuracies. In complex multilingual cultures, language variety has a significant impact on the interaction between different languages (Arifin, 2016). The phenomenon of language interaction, known as language interference, is one of responsible aspect for several linguistic effects that are unavoidable (Calabria et al., 2018). Language interference, as defined by Weinreich (1957) as cited by Syafutri, T., & Saputra (2021) is the departure from the linguistic norms of one language that happens in the speech of bilingual individuals due to their proficiency in many languages. It is the deviation of language norm in usage as the effects of multilingual toward some other languages (Alkhudiry & Al-Ahdal, 2020).

According to the idea proposing that when individuals try to learn a second language, their existing habits sometimes affect the way they speak the target language. This is due to the presence of a latent psychological structure in their brains that will be triggered automatically. It is conceivable for it to make pronunciation errors, akin to those produced by native speakers or second language learners. Language learners generate utterances that differ from those of native speakers, yet they continually strive to convey the same meaning. Consequently, the generation of sounds is altered when learning a second language due to the influence of habits from one's native language. This occurrence is commonly known as interference (Derakhshan & Karimi, 2015).

Indonesia possesses a linguistic diversity with over 580 languages and dialects spoken inside its borders (Seifart, F., Evans, N., Hammarström, H., & Levinson, 2018). Due to Indonesia's intricate sociocultural context, the majority of its residents possess the ability to learn and use a minimum of two languages: local languages and Indonesian, which serves as the national language. Wahyuningtyas et al., (2021) agreed with the statement and added whether cultural distinction can be avoided by maintaining the local languages. In addition, the contemporary Indonesian language has emerged as a result of sociocultural interactions among individuals from diverse ethnic backgrounds, leading to the creation and acceptance of linguistic terminology that are understood and used by its speakers as Indonesian (Lie, 2017). In fact, according to Arnhold, A et all, (2020) individuals' pronunciation can be shaped by their mother tongue and local accents. Occasionally, we can ascertain an individual's place of origin by analyzing their pronunciation of specific words or sounds. Nevertheless, it is crucial to bear in mind that each individual's pronunciation is distinct and can also be influenced by circumstances such as their surroundings, age, and level of education (Muhassin et al., 2018).

Langsa is a municipality located in the province of Aceh, which is situated in Indonesia. The distance from Banda Aceh city to the location is roughly 400 kilometers. The population of the area in 2021 was estimated to be at 185,622 individuals, resulting in a population density of 707 individuals per square kilometer. Langsa is designated as an administrative city as per Government Regulation Number 64 of 1991, which pertains to the establishment of administrative cities. Langsa City was granted its enhanced status by the enactment of Law Number 3 on June 21, 2001. The establishment date of Langsa was designated as October 17, 2001. The city is renowned for its prominence in education, trade, gastronomy, and tourism.

The city's population is predominantly composed of Acehnese, Malays, Javanese, Chinese, Gayo, Batak, Alas, and Karo ethnic groups. Langsa is the second most developed and populated city in Aceh province, following Banda Aceh. The predominant languages spoken by the residents of Langsa are Malay and Acehnese. Nevertheless, Indonesian continues to be the predominant language and has evolved into a common language for interethnic communication, particularly when conversing with migrants residing outside Aceh province. The presence of multiple languages increases the likelihood of linguistic interference that are possible to find in many public areas (Baghirova, 2021). This study examines the impact of Acehnese language contact on the Indonesian language in Langsa, specifically focusing on the occurrence of interference and consonant variants.

Numerous studies on phonology and phonetics have been carried out by popular linguists, including Chomsky, Katamba, and Haley. Nevertheless, linguistic professionals, particularly in Indonesia, should devote more attention to the research of sociophonetics, specifically regarding the production and perception of language variants. Hence, the researchers analyze recent studies on sociophonetics and expound on the impact of this research in enhancing the examination of interference and consonant sound variations among Acehnese speakers when speaking the Indonesian language. The scholars who have conducted research on the sociophonetics of language variation production and perception include Rebecca Roeder, Zsuzsana Fagyal, Jen Hay, and Adriano Trovato

Roeder (2011) argues that the conditioning effects of following manner and consonant sounds have the most significant impact. The study demonstrates that the substantial increase of /ae/ before nasal sounds serves as an indicator of adaptation to Non-Continuum Speech (NCS) among Mexican-American English speakers in Lansing. In Fagyal's (2011) study, the author examines the similarities and variations in the individual parts that make up the rhythm patterns observed in the speech of two distinct groups of teenage boys. The recordings were made in a working-class suburb of Paris, France. Therefore, the prediction that AF (French Arabic) readings would exhibit a stronger resemblance to stress-timed languages should be dismissed, as their rhythms align with syllable timing, similar to EF speakers.

Conversely, Hay (2011) states that their logistic regression research revealed a clear association between social class and the occurrence of /r/ insertion. Specifically, individuals from higher social classes had a much lower risk of utilizing disruptive /r/. In addition, he discovered that linguistic elements, such as the previous vowel and the following prefix, had a significant impact on the probability of /r/-insertion. These results cast significant doubt on current phonological analyses that consider intrusive /r/ as a simple, absolute, and non-variable phonological process. The frequency and intensity of /r/ are significantly influenced by linguistic and social factors. These findings also prompt a broader inquiry into the extent to which 'frequency' can be synonymous with 'degree' in other phonological sound alterations that have traditionally been examined as categorical. Trovato (2017) demonstrates that bilingual speakers from El Paso, Texas, can clearly differentiate between bilabial and labiodental voiced segments in terms of auditory perception. Furthermore, this discrepancy was associated with the consonant orthography and position of the linguistic factors inside the word. The key social determinants that had the largest impact on labiodentalisation were the individual's level of proficiency in English writing, competence in Spanish writing, and gender. The most effective auditory indicators for variations in labial sounds in the tested dialects were relative strength and duration.

Moreover, numerous research have been conducted to investigate linguistic interference. As an illustration, Mathieu, Kristin & Jonathan, (2017) examined the bilingual error in a language switching context. They found that language interference initiated the errors. In a study conducted by Tabri, F. K., & Said (2022), language interference in the Chinese community in Indonesian setting was examined. It was discovered that errors in language usage were mostly caused by the influence of the morphological aspects, specifically in the form sentence structure pattern and question sentence pattern. Fauziah (2015) states that Angkola Batak undergraduate students exhibit two forms of pronunciation deviations: devoicing and allophonic shift. The allophonic shift specifically involves a transition between /ə/ and /e/, as well as between /e/ and /ə/. Deviations exclusively manifest in the middle and final positions of the syllable. During all reported instances of devoicing alternations, the phoneme /b/ is realized as [p], /d/ is realized as [t], and /g/ is realized as [k]. However, the alternation exclusively takes place when the phoneme is positioned as the coda of the syllable, and no alternation is observed in the starting position. Suhery (2018) argues that phonological interference in Indonesian phrases from the Singkil language might be attributed to certain phonological processes, such as fortition (reinforcement). Fortition of the sound 'x→k' in the word 'worry' [xawatIr] changes to [kawatIr]. The sound 'f→p' in the word 'factor' [factor] transforms into [paktor]. The sound 'v→p' in the word 'voli' [voli] turns into [poly]. The sound 'z→ɟ' in the word 'nutrition' [nutrition] becomes [giɟi]. Glottal insertion (ʔ) occurs in words like 'until' [until], which becomes [sampɛʔ]. Loss of aspiration (deaspiration) happens in words like 'far' [ɟauh], which becomes [ɟau:]. The sound 'b→p' voicing occurs in words like 'sabtu' [sabtu], which becomes [saptu]. The sound 'd→t' occurs in words like 'maksud' [maksud], which becomes [maksut]. Monophthongisation occurs in words like 'or' [or], which becomes [ato]. Loss of initial consonant happens in words like 'alone' [saɟa], which becomes [a a]. Loss of

initial syllables occurs in words like 'once' [səkali], which becomes [times]. Loss of vowels occurs in words like 'that' [it], which becomes [tu]. Lastly, front vowels change from 'o→e' in words like 'number' [number], which becomes [number] and in the context of a pretest, the pronunciation of 'near' [dəkat] changes to [dəket]. Moreover, research conducted by Wolfsthurn et al., (2021) Examine the effects of cross-linguistic interference on German low proficiency late Spanish learners. Using a syntactic violation paradigm, they investigated the modulating influence of gender congruency and cognate status. The findings show that participants were more perceptive to gender congruency or syntactic similarities than to phonological and orthographic overlap or cognate status.

The study conducted by Weda & Sakti, (2018) aimed to investigate the impact of formal instruction on the learning of English short vowels among students enrolled in the English Literature Study Program at the Faculty of Languages and Literature at Universitas Negeri Makassar, Indonesia. Their research findings demonstrated that formal training had a substantial impact on enhancing the students' capacity to acquire English short vowels. Additionally, it was shown that a significant proportion of the students exhibited a tendency to inaccurately transcribe brief vowels as extended vowels. As an illustration, they frequently substituted the letter ə with e, such as in the word "docter," and replaced the letter ɪ with i, as seen in the word "sit." This implies that the students may have encountered difficulties in accurately distinguishing between short and long vowel sounds in the English language. The findings underscore the significance of well-executed formal teaching in tackling this matter and enhancing the students' aptitude in accurately articulating and transcribing English short vowels.

Furthermore, in a study conducted by Aziz & Amery (2023), the researchers examined the vowel changes that occurred in Indonesian loanword within the Acehnese dialect. The researchers found that the phonological aspect was the main cause of the changes, so that Indonesian loanword sounding typically Acehnese. Utami et al., (2017) also did a study to examine the phonological interference of students' native language in their pronunciation of English sounds. They discovered that there are three primary elements that impact children while pronouncing English words. (1) The interlingual component pertains to the impact of the pupils' native language (L1) on their English pronunciation. The phonetics and phonological patterns of their mother tongue can impact their proficiency in appropriately articulating English phonemes. (2) The phenomenon of overextension of analogy: This element indicates that students may mistakenly use the pronunciation patterns of their native language while pronouncing English words, even if those patterns do not actually apply. For instance, individuals could employ comparable phonetic or structural elements from their mother tongue when articulating English vocabulary, leading to inaccurate pronunciation. (3) Structural transfer: This element suggests that students may apply the grammatical structure of their native language to English words, thus impacting their pronunciation as well. This may entail the application of erroneous stress patterns or intonation derived from their mother tongue to English words. The study posits that Buginese and Makassarese pupils possess knowledge of the pronunciation norms in English, although occasionally fail to execute them accurately. The potential causes for this forgetting include interference from their first language, memory problems, psychological concerns, or a lack of comprehension of the subject matter. These variables can impede their capacity to regularly articulate English consonants with precision.

However, there is a lack of study conducted on language interference in Indonesian contexts, specifically involving Acehnese, particularly utilizing acoustic phonetic analysis. This subsequently emerges as the distinctive feature of the present investigation. This study aims to examine whether Acehnese speakers exhibit dissimilarities in consonantal variation while speaking the Indonesian language. It also analyzes the overall characteristics of pronunciation deviations in Indonesian that may produce by Acehnese speakers residing in Langsa.

Additionally, it seeks to determine how acoustic phonetic measures can capture the difference in sound variation that occur.

In a report regarding Spanish interference, Tavarez DaCosta & Alvarado (2020) described interference as the act of obstructing or impeding something, as well as the process of blending or combining elements together. Linguistic transfer, often known as linguistic interference, implies that some form of influence is necessary for it to happen and it may affects the subsequent language (Schmid & Köpke, 2017)**.** Weinreich was the inaugural linguist to employ the term 'interference' in the context of language usage. According to Abduhamidovna (2020), interference is defined as the unconscious transfer of the superficial characteristics of the native language to the surface of the second language due to habitual patterns. The phrase refers to a phenomenon when bilingual people blend or incorporate components from a foreign language into the language they are using, resulting in alterations to the linguistic system (Duff & Duff, 2019). According to Andika & Abdullah (2018) there is a strong correlation and reciprocal impact between bilingualism and interference. An everyday event that exemplifies this is when someone employs language as a means of communication. In Indonesian society, the linguistic condition of most Indonesian speaking communities is defined by the usage of two languages: the local language as the mother tongue and Indonesian as the national language. This type of usage scenario can result in the amalgamation of regional dialects and the Indonesian language. Bilingualism refers to the practice of utilizing two languages interchangeably, which might potentially result in interference (Jevtović, Duñabeitia, & de Bruin, 2020). Language interference is caused by a variety of factors, such as the expansion or narrowing of the use of a grammatical form, the model of one language under the influence of another, the transfer of grammar from one language to another, the elimination of one language by the pattern of another language, and the change of grammar in one language in another language (Turdaliyevich, 2022)

Moreover, various factors elicit language interference, which manifests in both oral and written communication. Sekartaji (2013) identifies vocabulary characteristics, notably in the word and grammatical structure of two languages, as the primary factor responsible for interference. In an article, Xia et al. (2022) identifies additional elements that contribute to interference, such as bilingualism. Bilingual speakers experience language contact, which can influence the source language through the influence of foreign or local languages. Language interaction ultimately leads to interference. The Acehnese and Indonesian languages underwent language contact, in this study. The lack of knowledge regarding linguistic rules and the incorporation of aspects from other languages also leads to the occurrence of diverse forms of interference. The impact of native languages on individuals' usage of their second language is another contributing aspect. For instance, when a youngster starts to communicate, they are introduced to Acehnese, indicating that Acehnese is their first language. Utilizing Acehnese in other languages on a regular basis might lead to a fusion of vocabulary and linguistic structures. For instance, when individuals converse in Indonesian, a bilingual individual may possess a mental representation of the Indonesian language. However, what emerges unexpectedly is not the vocabulary of the Indonesian language, but rather the vocabulary or linguistic patterns from the Acehnese language, with which the individual is acquainted. This scenario may arise as a result of a disparity in the process of acquiring language. The reason for this is the challenges faced by native speakers of a first language when employing a second language. Bilingual individuals tend to include a greater number of linguistic components from their original language, rather than the second language they are currently using. Thus, this study seeks to investigate how Acehnese speakers produces differences in consonant variations? What are the characteristics of Indonesian pronunciation deviations produced by Acehnese speakers residing in Langsa? And which gender demonstrate significant and minimal phonological interference within the speech community?

RESEARCH METHOD

Research Design

This study employed a descriptive qualitative technique, especially utilizing a case study research design with the support of descriptive quantification, in accordance with the nature of the research issue. Qualitative research is a method of investigation that aims to comprehend social or human issues by constructing a comprehensive and interconnected representation using verbal descriptions, presenting in-depth perspectives of those involved, and carried out in authentic environments (Creswell, 2014).

The research utilized a descriptive case study as its selected method of analysis. Descriptive case studies seek to provide a comprehensive and in-depth comprehension of a specific occurrence within its context. Hence, this design aligns with the study's objectives, which aimed to examine if Acehnese speakers exhibit differences in consonant variation when speaking Indonesian, analyze the overall characteristics of Indonesian pronunciation deviations made by Acehnese speakers residing in Langsa, and determine which gender demonstrates significant and minimal phonological interference within the speech community. The data were obtained by conducting comprehensive interviews and recording the speakers' utterances.

Location and Subject

The research was conducted in Langsa and involved a sample 40 participants, comprising an equal number of males and female who are proficient in the Acehnese language. The subjects were purposefully selected based on specified features. The informants are selected based on specific criteria; Langsa residents who are native speakers, age ranging from 10 to 61 years and older, physically and cognitively sound (without speech impairments), education at the level of primary school, proficient in both Acehnese and Indonesian languages, and acquire proficient mother tongue.

The age range of the subjects in this study is between 10 to 20 years old, 21 to 40 years old, 41 to 60, and 61 years old and above. The table below displays the distribution of informants according to their gender and age.

Table 1
Subject Description

Gender	Age 10 - 20 years old	Age 21 - 40 years old	Age 41 - 60 years old	Age 61 years old and above	Total
Male	5	5	5	5	20
Female	5	5	5	5	20

Data Collection

The analyzed and researched sounds were limited to three consonant plosives: /b/, /d/, and /t/. The participants were instructed to identify several words, including: Abdi, jawab, telinga, tetap, and ahad. Subsequently, their vocalizations were recorded utilizing a TASCAM recorder.

Data Analysis

After the data were collected, they were transcribed and analyzed using software known as PRAAT. PRAAT is a open-source software program that is utilized for the examination, generation, and manipulation of sound Boersma & Van Heuven (2001) as cited by Eshkol-Taravella, I., Maarouf, M., Badin, F., Skrovec, M., & Tellier, 2020). It has a great effect on voice-assisted teaching, voice autonomous learning and voice error correction (Chunyu, 2016). An inherent constraint of this software is its lack of editing functionality. Consequently, the Wave pad sound editing software was utilized to trim the audio file.

Before transcription, the recordings were transcribed using orthographic transcription by a single native Indonesian speaker. The use of a native Indonesian speaker in the transcribing process aimed to reduce the occurrence of copying errors. The transcriptions were subsequently compared, and any discrepancies were resolved through the process of negotiation. Subsequently, any divergences from the desired sound generated by the participants were gathered. The frequency of deviations was thereafter computed and subsequently compared utilizing a scale developed by Thorsten (1992) as cited by (Salma, 2013), denoted as: P = F/N (P= Percentage, F= Frequency, and N= Number of participants).

RESEARCH FINDINGS AND DISCUSSION

Research Findings and discussion

The research findings indicated that among all the phonemes produced by the subjects, a specific sort of pronunciation defect seen was devoicing. Below is a summary of the pronunciation variations.

Table 2
Pronunciation Deviations Produced by Participants

Types of Deviation	Measurement	Frequency	Percentage (%)
Devoicing	Reading Task	-	-
	Abdi	36	90%
	Jawab	40	100%
	Telinga	16	40%
	Tetap	16	40%
	Ahad	40	100%

Devoicing involves Crowley's classification of lenition, where the voice undergoes a weakening process. The above table depicts the many types of pronunciation variations seen in participants. These deviations were determined by having the participants read words and subsequently rate the frequency of each deviation. The following is a description of the table above:

The researchers identified many instances of pronunciation abnormalities in the reading task, which were classified as "devoicing". Devoicing is the phonological phenomenon in which voiced consonants, such as /b/ and /d/, are articulated without vocal cord vibration, resembling voiceless consonants. However, the phoneme /t/ is often spoken with a sudden release of air and without vocal cord vibration, but in this case, it is pronounced [t^h] with a forceful release of air and with vocal cord vibration.

(1) The participants' pronunciation of the word [ab.di]:

The participant said the word "Abdi" with devoicing 36 times. This led to a deviation in devoicing of nearly 90%. Typically, the term Abdi is spoken with consonantal sound vibration [ab.di]. On the contrary, the participants articulated it without the phonetic resonance [ab.di]. ticipants' pronunciation of the word [ap.di]:

(2) The participants' pronunciation of the word [ʤa.wap]:

The participant who pronounced the word [ʤa.wap] encountered 40 occurrences of devoicing variation during the reading activity. The outcome yielded a deviation percentage of 100% in terms of devoicing. It is evident that in every instance, the participant consistently pronounced the consonant that should have had the sound vibration [ʤa.wab] as [ʤa.wap].

(3) The participant pronounced the word [thə.linga]:

A total of 16 occurrences of devoicing variation were detected when the participant articulated the word "telinga" throughout the reading task. This participant exhibited a devoicing deviance of 40%. This demonstrated that in few instances, the participants articulated the consonant with an aspirated phonation in [t^hə.linga], while in the majority of situations, they pronounced it without any phonatory vibration [te.linga].

(4) The participant pronounced the word [tə.thap]:

The participant who pronounced the word [tə.thap] also exhibited 16 occurrences of devoicing deviance throughout the reading test. The devoicing deviance exhibited a 40% rate, mirroring the trend observed in participants who articulated the word [tə.t^hap].

(5) Participants pronouncing the word [a.hat]:

The participant who articulated the word [a.hat] exhibited 40 occurrences of devoicing variation during the reading test, resulting in a devoicing rate of 100%. This demonstrates that in every instance, the term [a.hat] should have been articulated as [a.had] without any vocal quivering.

Based on the data, it can be observed that participants commonly diverge from devoicing pronunciation during reading activities. The degree of variance ranges from 40% to 100% and is contingent upon the participant. The findings revealed that the participants' pronunciation style was influenced by their linguistic features or their native language.

Devoicing

The consonants investigated in this research were plosives, as determined by the pilot test conducted prior to the study. Plosives, also known as stops, are noises that involve (1) the blockage of airflow from the lungs by a specific articulator, (2) the compression of air pressure, and (3) the subsequent release of the blockage. To overcome the challenge of identifying plosives just through audio, further acoustic analysis was conducted utilizing PRAAT software. In spectrographic presentation, plosives are typically identified by the presence of silence (stop-gap) or a noticeable decrease in signal intensity, which corresponds to a period of articulatory blockage where little to no energy is produced. However, it is also contingent upon the prosodic conditions. Subsequently, there is a surge of vigor, like to the release of a closure.

When identifying and distinguishing each plosive, two aspects must be taken into account. One aspect is the distinction between fortis and lenis consonants, which refers to the differentiation between voiced and voiceless sounds. Based on Yavas (2011: 108), the following signs can assist in identifying stops in relation to this dimension: Length of the stop-gap or silent during the concluding phase. The duration of the silent phase for the sound /t/ is greater than that of /b/ and /d/. The spectrogram exhibits voice bars, which are dark bars typically seen at frequencies below 250 Hz. Nevertheless, this is one of the least distinguishing attributes of stop sounds, as it can only be employed to differentiate /t/ from /b,d/ in positions between vowels. In such cases, /b,d/ will exhibit a vocalic bar suggesting voicing, whilst /p,t/ will not. Emitting a sudden surge represented by a distinct vertical spike. Typically, there is a greater increase in intensity for the sound /t/ compared to the sounds /b/ and /d/. Velar stops are more susceptible to non-release compared to bilabials or alveolars. And Aspiration is the occurrence of a short friction sound that happens before the creation of a vowel and typically lasts than 30 milliseconds. It manifests in the articulation of /t/ at the beginning of the emphasized syllable. Aspiration and bursts of release are distinct in terms of duration, with aspiration lasting longer than bursts of release.

After analyzing the data in accordance with the guidelines, it was determined that bilingual individuals encountered difficulties in producing voiced plosives /b/ and /d/. They have a tendency to convert voiced plosives, particularly those in the final position, into voiceless

plosives. Alternation, or devoicing, is the phenomenon when there is a loss of sound in final obstruents, typically happening at the end of a syllable. Morley (2019) categorizes the phonetic transformation as lenition, wherein a stronger sound undergoes a transition to a weaker sound. During all reported deviations, the phoneme /b/ is manifested as [p], while the phoneme /d/ is manifested as [t]. However, the alternation exclusively takes place when the phoneme is positioned as the coda of the syllable, and no alternation is observed in the starting position. The table below illustrates this.

Table 3
The Devoicing Alternations Seen in the Preceding Word List

Phonem	Input	Participants Actual Pronunciation	Deviation	Participants
B	/abdi/	[ap.di]	[b → p]	
				P1, P2, P3, P4, P5, P6, P7, P8, P9, P10, P11, P12, P13, P14, P16, P17, P18, P19, P20, P21, P22, P23, P24, P26, P27, P28, P29, P30, P31, P32, P34, P35, P37, P38, P39, P40,
B	/jawab/	[ʤa.wap]	[b → p]	All Participants (P1 - P40)
				P1, P2, P3, P4, P5, P6, P7, P8, P9, P10, P11, P12, P13, P14, P15, P16, P17, P18, P19, P20, P21, P22, P23, P24, P25, P26, P27, P28, P29, P30, P31, P32, P33, P34, P35, P36, P37, P38, P39, P40.
T	/telinga/	[tʰə.liŋa]	[t →th]	
				P8, P12, P14, P16, P23, P24, P28, P29, P30, P31, P33, P34, P35, P36, P37, P38.
T	/tetap/	[tə.tʰap]	[t →th]	
				P8, P12, P14, P16, P23, P24, P28, P29, P30, P31, P33, P34, P35, P36, P37, P38.
D	/ahad/	[a.hat]	[d → t]	Whole participants (P1 - P40)
				P1, P2, P3, P4, P5, P6, P7, P8, P9, P10, P11, P12, P13, P14, P15, P16, P17, P18, P19, P20, P21, P22, P23, P24, P25, P26, P27, P28, P29, P30,

Phonem	Input	Participants	Actual Pronunciation	Deviation	Participants
					P31, P32, P33, P34, P35, P36, P37, P38, P39, P40.

The above table displays the pronunciation of plosive consonant phonemes /b/, /t/, and /d/, along with observations of pronunciation abnormalities observed in several participants. The results were described as follows: A phoneme is a linguistic element that carries semantic significance and represents a distinct sound in a language. The phonemes noticed in the table are the plosive consonants /b/, /t/, and /d/. Inputs consist of words that contain the phonemes that have been observed. As an illustration, in the initial line, the input is "/abdi/", whereby the phoneme /b/ is present.

The term "actual pronunciation" refers to the precise representation of the input's pronunciation in a phonetic transcription. As an illustration, the phonetic transcription of "/abdi/" is [ap.di]. Deviation is the disparity between the actual pronunciation and the anticipated standardized form. These abnormalities manifest as alterations in particular phonemes or sounds. For instance, the notation [b → p] indicates a shift in the pronunciation of the sound /b/ to [p]. Participants refer to the group of individuals that were observed and studied in this research. The labels assigned to them are P1 and P2.

In line 1, the outcome (b /abdi/ ... [b → p]) indicates that participants P1 to P40 pronounced the phoneme /b/ as [p] in the word "/abdi/". This is an instance of deviation in which the anticipated pronunciation of the sound /b/ is altered to [p]. In line 2 (b /answer/ All Participants): The phoneme /b/ in the word "/answer/" is consistently pronounced as [p] by all participants, ranging from P1 to P40. These findings indicate that all participants had a comparable divergence in the enunciation of this term. Next, in line 3, the phoneme /t/ in the word "/ear/" is pronounced as [th] by the participants indicated in the Respondent column. Only the individuals indicated in this row encountered this variance in this specific word. Subsequently, in line 4 (t /tetap/ [t →t^h], the phoneme /t/ in the word "/tetap/" is articulated as [t^h] by the individuals named in the response column. Only the subjects named in this row encountered this variance in this specific word, just like before. In line 5, all participants (from P1 to P40) pronounced the phoneme /d/ in the word "/ahad/" as [t]. These findings indicate that all participants had a comparable divergence in the enunciation of this term.

Acoustic phonetics analysis

The study identified the occurrence of devoicing, wherein voiced sounds, typically consonants, undergo a transition to a voiceless or almost voiceless state under specific circumstances. Devoicing is a widespread phenomenon in many languages worldwide, and the purpose of acoustic analysis of devoicing alternations is to identify and examine the acoustic modifications that take place during this process. The study establishes a connection between the duration of consonants and vowels and the occurrence of devoicing, which refers to the transformation of a voiced stop sound into a voiceless sound or a sound that resembles a vowel. The duration of consonants and vowels can impact the occurrence of devoicing, as duration is a key acoustic attribute that can influence the quality of sounds.The table below presents a summary of the results from the acoustic phonetic analysis on the duration of voiced and voiceless plosive consonants in the initial, middle, and final positions as produced by the participants.

Table 4

Duration of Voiceless Plosive Consonants [ap.di] and [ʤa.wap] Produced by Male Participants

No	Participants	Age (Year)	Duration [ap.di]	Duration [b → p]	[ʤa.wap]	[b → p]
1	P 1	13	0.16555 ms	0.0072 ms	0.45552 ms	0.1733 ms
2	P 2	19	0.86456 ms	0.1845 ms	0.662463 ms	0.2351ms
3	P 3	11	0.915763 ms	0.3044 ms	0.534913 ms	0.1849 ms
4	P 4	12	0.720049 ms	27744 ms	0.570429 ms	0.1650 ms
5	P 5	10	0.900741 ms	0.213988 ms	0.537459 ms	0.1620 ms
6	P 6	25	0.318540 ms	0.0564 ms	0.455228 ms	0.0950 ms
7	P 7	35	0.404002 ms	0.0653 ms	0.354992 ms	0.0582 ms
8	P 8	23	0.476581 ms	0.0682 ms	0.446498 ms	1.4018 ms
9	P 9	29	0.513996 ms	0.0922 ms	0.386634 ms	0.0642 ms
10	P 10	39	0.640606 ms	0.1202 ms	0.790326 ms	0.0713 ms
11	P 11	45	0.494414 ms	0.1133 ms	0.353153 ms	0.1191 ms
12	P 12	55	0.473418 ms	0.0813 ms	0.334283 ms	0.1053 ms
13	P 13	50	0.419849 ms	0.0962 ms	0.565031 ms	0.1002 ms
14	P 14	52	0.496667 ms	0.0873 ms	0.393700 ms	0.1112 ms
15	P 15	43	0.538806 ms	0.1093 ms	0.529353 ms	0.1213 ms
16	P 16	61	0.583615 ms	0.0942 ms	0.524109 ms	0.0942 ms
17	P 17	68	0.561903 ms	0.0755 ms	0.431919 ms	0.086 ms
18	P 18	61	0.643687ms	0.1232 ms	0.397407 ms	0.132 ms
19	P 19	61	0.626618 ms	0.1701 ms	0.563406 ms	0.162 ms
20	P 20	61	0.824348 ms	0.1802 ms	0.804814 ms	0.160 ms

The data presented above illustrates the time measurements of the participants' pronunciation of [ap.di] and [ʤa.wap], both before the consonant [b] transition to [p]. The data was collected to analyze the variation in the time of pronunciation for specific consonants in a particular language. The data comprised participants' names and gender, with the age of each participant recorded as an additional variable that could potentially influence the pronunciation pattern. The primary data recorded was the pronunciation duration, measured in milliseconds, for each pronunciation condition and word type. Participants exhibited variability in the duration of articulation of [ap.di] before [b] and transitioning to [p]. In the initial participant, the duration of pronunciation for [ap.di] prior to [b] was 1.656327 milliseconds, while before [p] it was 0.071134 milliseconds.

Furthermore, the data revealed variations in the length of articulation for [ʤa.wap], prior to [b] and [p]. As an illustration, in the second participant, the length of time it takes to pronounce [ʤa.wap] before [b] is 0.862782 milliseconds, and before [p] is 0.180 milliseconds. This suggests that there are differences in the length of pronunciation in specific pronunciation situations prior to the sounds [b] and [p] in the two categories of words. Certain participants exhibit substantial temporal disparities between the sounds [b] and [p] in both word types, whilst others may display less variability. The table below presents the data arranged in descending order of duration for each male participant, categorized by age.

Table 5
The Maximum and Minimum Duration for Each Male Participant Categorized by Age

No	Participant	Age	Duration [ap.di]	Duration [b → p]	Duration [ʤa.wap]	Duration [b → p]
1	P 3	11 thn	0.915763 ms	0.3044 ms	0.534913 ms	0.1849 ms
2	P 5	10 thn	0.900741 ms	0.213988 ms	0.537459 ms	0.1620 ms
3	P 4	12 thn	0.720049 ms	0.27744 ms	0.570429 ms	0.1650 ms
4	P 1	13 thn	0.16555 ms	0.00723 ms	0.45552 ms	0.1733 ms
5	P 2	19 thn	0.86456 ms	0.1845 ms	0.662463 ms	0.2351 ms
6	P 6	25 thn	0.318540 ms	0.0564 ms	0.455228 ms	0.0950 ms

No	Participant	Age	Duration [ap.di]	Duration [b → p]	Duration [ʤa.wap]	Duration [b → p]
7	P 8	23 thn	0.476581 ms	0.068 ms	0.446498 ms	1.4018 ms
8	P 9	29 thn	0.513996 ms	0.092 ms	0.386634 ms	0.064 ms
9	P 7	35 thn	0.404002 ms	0.0653 ms	0.354992 ms	0.058 ms
10	P 10	39 thn	0.640606 ms	0.120 ms	0.790326 ms	0.071 ms
11	P 11	45 thn	0.494414 ms	0.113 ms	0.353153 ms	0.119 ms
12	P 15	43 thn	0.538806 ms	0.109 ms	0.529353 ms	0.121 ms
13	P 14	52 thn	0.496667 ms	0.087 ms	0.393700 ms	0.111 ms
14	P 13	50 thn	0.419849 ms	0.096 ms	0.565031 ms	0.100 ms
15	P 19	61 thn	0.626618 ms	0.170 ms	0.563406 ms	0.162 ms
16	P 18	61 thn	0.643687 ms	0.123 ms	0.397407 ms	0.132 ms
17	P 20	61 thn	0.824348 ms	0.180 ms	0.804814 ms	0.160 ms
18	P 12	55 thn	0.473418 ms	0.081 ms	0.334283 ms	0.105 ms
19	P 16	61 thn	0.583615 ms	0.094 ms	0.524109 ms	0.094 ms
20	P 17	68 thn	0.503280 ms	0.075 ms	0.431919 ms	0.086 ms

The table displayed the duration ordered from the highest to the lowest, for each participant and age group. The data is arranged according to the duration of the word "abdi" [ap.di], leading to the subsequent sequence of participants. It showed that participant P3, who was 11 years old, had the longest [ap.di] with a length of 0.915763 milliseconds, participant P5, who was 10 years old, had a [ap.di] duration of 0.900741 ms. participant P4, who is 12 years old, has an auditory perception duration of 0.720049 milliseconds. ...and so on in sequential order. Then, the data is arranged in ascending order based on the duration from b to p. Participant P 1 exhibits the greatest duration of [b → p] at 0.00723 ms, participant P 2 has a duration of 0.1845 ms for the [b → p] task, and articipant P 3 has a duration of 0.3044 ms for the [b → p] event. ...and so forth in sequential order.

Subsequently, the data is organized according to the period of [ʤa.wap]:
Participant P 10 has the highest duration of [ʤa.wap], which is 0.790326 ms.
Participant P5, who is 10 years old, has a [ap.di] duration of 0.900741 ms.
Participant P4, who is 12 years old, has a duration [ap.di] of 0.720049 ms. ...and so on in sequence.
Ultimately, the data is arranged in ascending order based on duration [b → p]:
Participant P 8 has the longest duration of [b → p] at 1.4018 ms.
Participant P 2 has a duration of 0.235154 ms for the [b → p] task.
Participant P 6 has a duration of 0.0950 ms for the [b → p] event. The events are listed in sequential sequence.

The above table displays the duration of consonant sounds and extend of voice change, categorized by age and the specific type of consonant being analyzed. Initially, there were discrepancies in the length of consonant sounds and alterations in vocal characteristics that were influenced by age. Certain people had more pronounced variations in duration as they aged, whilst others did not demonstrate any discernible pattern. Naturally, the study of sound change focuses on the contrasts between speakers of various ages (Kong et al., 2022). Research conducted by D'Onofrio (2021) showed the similar that listeners of different ages in a Chicago-based American society produce and interpret vowels associated with the region's distinctive Northern Cities Vowel Shift (NCS), which is gradually reversing. Results from a vowel categorization task indicate that significant age differences arose in the opposite direction from those in production: for those features for which older speakers are reversing the NCS in production, younger participants significantly more strongly exhibit NCS-like perceptual boundaries than older speakers. Furthermore, the above findings revealed there was a wide range of variations in the duration of consonants [a.hat], [thə.liŋa], and [tə.thap]. Voiced

aspirated consonants typically have a greater length in comparison to voiceless consonants. Thirdly, there is a change in voice in the initial words of the middle section.

The temporal aspects of sound transitions, specifically from the voiceless alveolar plosive [t] to the voiceless dental fricative [th], manifest distinct characteristics contingent upon the positional context within a word. Notably, the duration of this sound transition is observed to be comparatively briefer when occurring in the word-initial position as opposed to its manifestation in the medial position within a word. This observation delineates a discernible variation in the articulatory mechanism governing sound production, contingent upon the specific location of the word within the sentence structure. In essence, the findings of this investigation illuminate pronounced disparities in both the temporal properties of consonant sounds and the associated phonetic modifications, contingent upon the age demographic of the study participants. The empirical data discloses a discernable trend wherein certain participants exhibit an elongation in the temporal duration of sound transitions as they advance in age. Consequently, the investigation did not reveal a homogeneous pattern across diverse age cohorts, indicative of individualistic variations in the articulatory dynamics and temporal characteristics of the [t] to [th] sound transition. This nuanced understanding underscores the complexity inherent in the articulatory processes and vocal dynamics associated with this phonetic transition, particularly as they unfold over the course of individuals' linguistic development.

Additional variables can also influence the length of the voice. Furthermore, the analysis of consonant duration differences reveals the presence of aspiration and voicing. Pronunciations such as [t^h ə.liŋa] and [tə.t^hap] typically have a longer duration compared to voiceless consonants like [a.hat]. It indicates that voiced aspirated consonants may entail greater intricacy in sound generation. The sound change on /t/ at the beginning and in the middle of the word, which results in the duration change from [t] to [t^h], is generally longer in the middle of the word compared to the change that occurs at the beginning of the word. This suggests that the alteration of the [t] sound to a [t^h] sound in the middle of a word may necessitate additional modifications during speech production. Furthermore, there exists a notable divergence among participants, even within the same age cohort, which is referred to as individual variability. These findings indicate that voice production is influenced by individual characteristics, such as speaking habits or anatomical diversity.

CONCLUSION

The findings of this research revealed that the participants exhibited devoicing, which refers to the absence of an obstruent voiced stop /b/ becomes an obstruent voiceless stop /p/, when pronouncing the word 'Abdi'. The percentage of deviating devoicing was roughly 90%. Typically, the word 'Abdi' was intended to be spoken with a consonantal sound resonance of [ab.di]. Conversely, the participants articulated it without the phonetic resonance [ap.di]. In addition, the participants said the word [ʤa.wap] and encountered 40 occurrences of devoicing deviance during the reading assignment. The outcome yielded a deviation percentage of 100% in terms of devoicing. The participants produced the consonant [ʤa.wap] instead of [ʤa.wab] as indicated by the absence of sound vibration from /b/ → /p/. Nevertheless, during the reading task, there were 16 occurrences of devoicing interference (deviation) noted when the participants articulated the word 'ear'. The subjects exhibited a devoicing deviation rate of 40%. This demonstrates that in certain instances, the participants articulated /t/ is an obstruent voiceless stop becomes /t^h/ is an obstruent voiced aspiration stop found in [t^hə.liŋa]. In addition, the individuals who articulated the word [tə.t^hap] also encountered 16 occurrences of devoicing deviance throughout the reading activity. The devoicing deviance had a 40% occurrence, mirroring the pattern observed in the subject who articulated the word [tə.t^hap]. Ultimately, the individual who articulated the term [a.hat] exhibited 40 occurrences of devoicing variation

during the reading assignment, resulting in a devoicing rate of 100%. This shows that on all occasions, the phoneme /d/ is a dental voiced stop from the word [a.had] becomes /t/ is a dental voiceless stop [a.hat].

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