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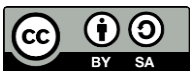

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"Interference of English Vowels by Dawan (Amarasi Dialect) Speakers

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Abstract

This study investigates the types of English vowel interference produced by ten native speakers of Dawan language (Amarasi dialect) using an acoustic phonetic approach. The participants were recorded producing English words containing nine target vowels (/iː/, /ɪ/, /ɛ/, /æ/, /ʌ/, /ɑː/, / ɔː/, /uː/, and /u/) The formant frequencies (F1 and F2) were analyzed using *Praat* software to identify deviations from English vowels and classify the types of interference**.** The analysis revealed three primary interference types: substitution, under-differentiation and reinterpretation. Substitution interference involved replacing English vowels /æ/ → [a] and /ɔː/ → [o]. Under-differentiation occurred when speakers failed to distinguish English phonemic contrasts in vowels /iː/→[ɪ] and /ʌ/ → [ɑː]. Reinterpretation was observed in fronted or centralized realizations of back vowels, such as /uː/ → [ʉ] or [y]. Vowel space contraction and centralization were found in both English target and informant products, indicating Dawan vowel characteristics impact English pronunciation. These results highlight that L1 phonology strongly affects L2 vowel production and propose vowel contrast awareness pronunciation training.

Keywords: *Amarasi dialect 1; Dawan language 2; Interference 3; Acoustic analysis 4; L2 pronunciation*

Introduction

Indonesia is home to numerous regional languages, one of which is Dawan, spoken on Timor Island. Dawan language comprises ten dialects, and Amarasi dialect belongs to the "R" cluster, characterized by the systematic replacement of /l/ with /r/ (e.g., "leko" → "reko" meaning "good") (Unab A and Djawa A n.d.).

Native speakers of Dawan Language, especially those who speak Amarasi dialect, consistently encounter difficulties in mastering the English vowel system while learning English as a second language. English consists of twelve monophthongs and many diphthongs, however Dawan language (Amarasi dialect)

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consists of only five vowel phonemes (Edwards 2016). For instance, English phonemes [e] and [ɛ] which are phonetically different, yet there is no similar difference in the Dawan vowel system. Consequently, speakers of Dawan tend to replace unfamiliar English vowel with the closest native phonemic equivalents, leading to systematic mispronunciation.

This phenomenon is known as language interference, occurs when elements of a speaker's first language affect their use of a second language (Hidayati et al. 2023). According to Nurhayat et al., (2021), interference is a common mistake among bilingual speakers, resulting from their ingrained knowledge of the primary language. Weinreich, (1979) observed that language interference can occur in various linguistic domains, including phonology, morphology, syntax, and lexicon.

As noted by Alwasilah (in Irma et al., 2019), language interference occurs when a speaker transfers the phonetic pattern of the first language (L1) to the second language (L2). Phonological interference can be classified into four types (Weinreich 1979); (1) under-differentiation when the L2 identify phoneme that lack contrast in the L1, leading to the neutralization of that contrast; (2) over-differentiation refers to the application of L1-specific phoneme distinctions to L2 sounds in the context when such distinctions are unnecessary; (3) re-interpretation entails aligning novel L2 phonemes with L1 categories according to perceived resemblances; (4) substitution occurs when L2 phonemes are substituted with the closest L1 equivalents due to variances in articulatory or auditory characteristics.

Numerous studies have investigated phonological interference, especially concerning its diverse manifestations. Rumalutur et al., (2021), in their study *Assessing the Interference of Mother Tongue Towards Students' Spoken English Ability at SMPN 39 SBT*. This research found four principal categories of phonological interference among Gorom speakers: (1) under-differentiation of phonemes, (2) over-differentiation of phonemes, (3) reinterpretation of distinctions, and (4) phoneme replacement.

Language interference is often regarded as negative transfer from L1 to L2 in second language acquisition (SLA) (Ellis, 1994). When learners apply the phonological pattern of their first language, to the target language, they commit systematic pronunciation errors**.** Selinker introduced the idea of "interlanguage" to describe this transitional linguistic system that blends L1 and L2 (Al-Khresheh 2015). Through the Speech Learning Model, Fledge, (1995) demonstrated that the phonetic categories of a learner's first language affect how they hear and make sound in a second language, which makes it hard to hear and make new vowel sound. Thus, studying Dawan English vowel interference reveals their interlanguage phonological system during L2 learning.

Further research has consistently demonstrated that vowel phonological interference is common among speakers of regional languages. Irma et al., (2019) noted that vowels such as [a], [ɔː], and [ɑː] frequently experience interference. In a related study, Nurhayat et al. (2021) discovered that the vowels [iː], [ae], [ɒ], [ɔː], [uː],

[əː], [ɑː], [e], and [ə] were frequently misarticulated by speakers of Banjar Hulu. Utami et al., (2017) reported twelve types of vowel mispronunciations among Makassarese speakers, whereas Susmita et al., (2023) documented eleven instances of vowel interference in Kerinci language speakers. The results suggest that the nature and extent of interference vary based on the phonological attributes of the speaker's first language (L1).

Besides interference-focused study, other acoustic phonetic studies have examined vowel features across languages. The first and second formant (F1 and F2) values are used to assess vowel quality across languages, and Hillenbrand et al., (1995) offered one of the first comprehensive assessments of English vowel acoustics. In an Acoustic Phonetic Analysis of Deli Malay Vowels, Aris et al., (2023) showed how formant measures may accurately describe vowel location and quality. Using acoustic phonetic analysis in their Prosody Study of Batak Angkola Language to show how frequency, duration, and intensity identify speech sounds. According to Raees Narhan et al., (2023), first-language influence was evident in the frequency, intensity, and duration of speech produced by native and non-native Turkish speakers.

According to Ambalegin & Hulu, (2019), Indonesian EFL learners' mispronunciations were mostly caused by the mother tongue and the inconsistencies between Indonesian and English phonetic systems. Gunadarma, (2024) analysed vowel production in Down Syndrome children using *Praat* and found that F1 and F2 values indicated improper tongue posture, demonstrating the effecacy of acoustic analysis in identifying articulatory variation.

These studies show that acoustic phonetics, particularly formant frequency measurement is a reliable and effective way to study vowel production and phonological interference across languages.

Despite the extensive research on phonological interference in other regional languages, studies focusing on English vowel interference among Dawan (Amarasi dialect) speakers remains limited. Most existing studies focus on auditory analysis while only a few have employed acoustic phonetic measurement of the first formant (F1) and the second formant (F2) to quantify vowel differences. Accordingly, this study aims to: 1) Identify the differences in acoustic values of the first formant (F1) and the second formant (F2) between English vowel and those produced by native speaker of Dawan language (Amarasi dialect) 2) Analyze the types of English vowel interference occurring in the speech of Dawan language (Amarasi dialect) based on the value of first formant (F1) and the second formant (F2) in acoustic analysis.

The types of vowel interference in the English pronunciation of Dawan speakers and to evaluate these patterns through acoustic analysis, particularly by measuring the formant (F1 and F2). This research is innovative due to its employs an acoustic phonetic method to investigate the underexplored phenomenon of phonological interference produced by Dawan speakers (Amarasi dialect) in acquiring English vowels. This study is innovative in its application of acoustic phonetic method. Acoustic phonetics is a branch of phonetics that examines the

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physical aspects of speech sounds represented as sound waves (Weenink 2025).

Acoustic phonetics primarily examines the vibrations of spoken sounds through the parameters of frequency, amplitude, duration, and formants. Sound vibration analysis can be conducted using *Praat* software. Vowels are examined by formant frequencies, which delineate the position of the articulators. The primary formants for assessing vocal quality are the first formant (F1) and the second formant (F2). The first formant (F1) corresponds to tongue height and lower. The second formant (F2) is related to the tongue's position in the front and back. Front vowels produce heightened F2 values, whereas back vowels result in reducing F2 values. Consequently, these two formants (F1 and F2) are highly effective in detecting vowel changes or interference.

Method

This objective of the study is to explain the phenomena of English vowel interference among speakers of the Dawan language. It applies a descriptive qualitative approach supported by acoustic analysis, which is appropriate for systematically collecting, measuring, and presenting data on the first formant (F1) and the second formant (F2). This method enables an objective description of the participants' vowel production based on the research questions. According to Mahsun (2017) descriptive research prioritizes the collection of comprehensive data to provide an accurate representation of linguistic phenomena.

Participants

Ten native speakers of Dawan language, specifically Amarasi dialect, participated in this study. The participants ranged in age from 18 to 25, with an average age of 21.4 years. All participants had received formal English instruction for a duration of 6 to 10 years, in formal education settings. All participants were undergraduate (S1) and diploma (D3) students from diverse majors at several universities, sharing a common linguistic background in Dawan language (Amarasi dialect).

All participants were capable of introducing themselves in English, and had the basic speaking skill needed for reading and pronouncing words. Despite lacking fluency, their practical knowledge enabled them to understand instructions and use basic English words. None of the participants had ever lived in an English-speaking country, ensuring that their English speech was mostly shaped by local educational influences rather than by being around people who spoke English.

Participants were chosen by purposive sampling to ensure linguistic homogeneity relevant to the study's focus. All were recruited from the Amarasi-speaking communities in Merbaun district of East Nusa Tenggara, Indonesia. This specific population was selected to represent speakers with a similar phonological background, enabling a focused analysis of vowel interference in English pronunciation.

Research instrument

The instruments used in this study included a voice recorder and a researcher-compiled English vocabulary list. A digital voice recorder (Oppo A20 smartphone) served as the audio recording device to record the participants' pronunciation of the selected English words**.**

The researcher created a wordlist of nine English words representing the monophthong vowel of American English: /iː/, /ɪ/, /ɛ/, /æ/, /ʌ/, /ɑː/, / ɔː/, /uː/, and /u/ These vowels were chosen because they are likely to pose difficulties for speakers of Dawan language (Amarasi dialect). The selected of vocabulary was based on the following criteria:

1. Vowel Representation: Each target vowel was represented by a single carefully selected word, allowing for a focused analysis of vowel production and the identification of interference patterns among participants.
2. Lexical Familiarity: Common and familiar vocabulary were selected to minimize comprehension difficulties. The majority of chosen words are fundamental vocabulary commonly instructed in secondary-level English education.
3. Basic Phonological Structure: The majority of words adhere to uncomplicated syllable patterns (CVC, or CCVC) to enable participants to concentrate on vowel articulation without the distraction of complex word forms.
4. Phonetic Environment Variation: The lexicon comprises several combinations of vowels with distinct initial (onset) and terminal (coda) consonants, facilitating the examination of coarticulatory effects. Although the majority of vowels occur in medial positions, the diverse surrounding consonant environments are sufficient to facilitate a phonetic-level analysis.

Data collection technique

The data collection method began with the preparation of an English word list followed by selection of participants based on predetermined criteria. Each informant was directed to articulate the prepared word list clearly and at a controlled pace. Audio recordings were conducted in a tranquil indoor setting using a smartphone (Oppo A60) equipped with a built-in microphone and a sampling rate of 44.1 kHz. To ensure high-quality and minimize background noise, all recordings were conducted in a quiet indoor environment devoid of external disruptions.

To strengthen the reliability of vowel data and reduce variability in spontaneous speech, the subsequent repetition strategy was employed:

1. Every word in the list was read sequentially twice by each participant during the first session.
2. After completing the entire list, participants were given a one-minute break, after the participants were directed to recite the entire word list.
3. As a result, each word was generated four times per participant (2 times × 2 rounds).
4. A 3–5 second pause was implemented between repetitions to ensure

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articulation stability to avoid vocal fatigue.

5. The researcher guided the recording session to guarantee good pronunciation and compliance with the protocol.

From the four repeats of each word, the two most acoustically stable products, determined by waveform clarity and formant stability, were chosen for further analysis using *Praat* software. Finally, the recordings were ultimately preserved in digital format and designated with each informant's code for subsequent processing.

Data analysis techniques

The data analysis applied an instrumental acoustic method using formant frequency measurements (F1 and F2) to identify vowel interference patterns. The analysis comprised the subsequent steps:

1. Formant Assessment and Verification

   All audio recordings were manually segmented and annotated using *Praat* software (version 6.3.16). F1 and F2 were measured at the middle (steady-state) for each target vowel to eliminate the impact of transitional sounds. Only clear, stable productions were incorporated into the final dataset.

   Vowel identity was determined based on its acoustic position in the vowel space, specially by analyzing the phonological characteristics of tongue height (F1) and tongue advancement or backness (F2). Reference values were drawn from the standard formant data of American English vowels reported by Hillenbrand et al. (1995). This offered an objective and replicable validation approach, eliminating the necessity for inter-rater transcribing.

2. Native speaker reference

   Since no native speaker group was included in this study, standardized acoustic data were used for comparison. The average F1 and F2 values for English vowels (/iː/, /ɪ/, /ɛ/, /æ/, /ʌ/, /ɑː/, / ɔː/, /uː/, and /u/) were specifically derived from Hillenbrand et al., (1995), widely acknowledged as a reliable source for American English vowels. This study presents average formant values generated by native speakers of both genders across diverse age groups. For the purpose of this study, the formant values for adult speakers aged 18 to 25 were chosen to correspond with the participants' age range. The reference values were used to identify and analyze vowel interference by comparing the participants' vowel output to native norms.

3. Classification of Interference

Vowel productions were classified into four categories of interference:

- Substitution: the substitution of English vowels with native Dawan vowels
- Under-differentiation: the amalgamation of distinct English vowels into a singular native category
- Reinterpretation: varied manifestation of reduced vowels (e.g., schwa) into full vowels
- Over-differentiation: refers to the application of L1-specific phoneme distinctions to L2 sounds in the context when such distinctions are unnecessary.

The categories were determined by clusters of F1-F2 values rather than listener assessment, so enhancing the objectivity of the classification.

4. Acoustic Data Representation

Vowel space charts (F1 vs. F2 plots) were used to demonstrate the Acoustic characteristics of the participants' vowel sounds. These visualizations illustrate the relative positions of target vowels and their realizations, enabling a clearer representation of vowel changes and possible interference patterns. The plots were created using the average F1 and F2 values for each participant and vowel, and were contrasted with reference values from Standard English vowels.

Results

1. Target F1 and F2 value

The table below presents the target F1 and F2 values for the English vowels analyzed in this study. These values are derived from the recognized acoustic norms of native American English speakers, as documented in previous phonetic study by Hillenbrand et al., (1995). These objectives function as reference points for analyzing the participants' vowel realizations and identifying potential phonological interference.

Tabel 1. Target F1 and F2 Value for English Vowels

No	Vowel	F1 Hz		F2 Hz	
		P	L	P	L
1	[iː]	437	342	2761	2322
2	[ɪ]	431	427	2365	2034
3	[ɛ]	731	580	2058	1799
4	[æ]	669	588	2349	1952
5	[ɑː]	936	768	1551	1333
6	[ʌ]	753	623	1426	1200
7	[ɔː]	781	652	1136	997
8	[ʊ]	459	378	1105	997
9	[uː]	519	469	459	378

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2. Vowel System of Dawan Language (Amarasi Dialect)

The following table shows the vowel system of Dawan language (Amarasi dialect). Each vowel is characterized by its articulatory position and lip rounding attributes. This representation provides a crucial basis for examining phonological variations and possible interference in the production of English vowels by Dawan speakers. Comprehending the phonetic characterization of each vowel enables the identification of both similarities and variations that may arise during second language acquisition.

Tabel 2. Vowel system of Dawan language (Amarasi dialect)

Vowel	Description
[a]	Low central unrounded vowel
[i]	High front unrounded vowel
[ʊ]	High back near-close rounded vowel
[ɛ]	Mid front unrounded vowel
[ɔ]	Mid back rounded vowel

The acoustic analysis of English vowels (/iː/, /ɪ/, /ɛ/, /æ/, /ʌ/, /ɑː/, / ɔː/, /uː/, and /u/) articulated by native Dawan speakers (Amarasi dialect) demonstrated consistent interference patterns, primarily shaped by the phonological constraints of their first language (L1). Vowel productions were analyzed using measurements of the first and second formants (F1 and F2) to identify variations from standard English vowel targets, specifically based on Received Pronunciation and General American norms.

3. First Formant (F1) and (F2) Values for Each Participant.

Tabel 3 presents the first formant (F1) and the second formant (F2) values and mean value for each vowel produced by participants. The first formant (F1) is for tongue height and the second formant (F2) is for tongue advancement or backness. This is the basic for analysing acoustic differences and identifying potential vowel interference.

Tabel 3. First formant (F1) and (F2) values for each participant

Vowel		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
/iː/	F1	566	361	351	332	367	356	418	357	413	343
	F2	2754	2647	2700	2601	2879	2422	2266	2197	2161	2210
/ɪ/	F1	415	402	571	377	431	414	381	370	397	402
	F2	2594	2125	2825	2053	2532	1927	1666	1997	1947	2137
/ɛ/	F1	790	705	743	713	833	540	638	547	559	643
	F2	2698	2478	2227	1683	2316	1891	1896	1951	1832	2034
/æ/	F1	701	507	684	672	579	548	567	523	520	609
	F2	2735	2328	2426	2213	2469	1716	1873	1935	1730	1999
/ɑː/	F1	758	821	748	776	1007	711	781	803	824	892
	F2	1017	1363	1179	1495	1479	1291	1530	1393	1432	1387
/ʌ/	F1	836	1074	809	709	977	735	820	771	793	805

	F2	1201	1748	1459	1657	1569	1391	1690	1708	1467	1539
/ɔː/	F1	548	1170	624	567	916	607	645	677	695	798
	F2	1457	1507	1118	1094	1308	845	1089	1247	1113	1445
/ʊ/	F1	505	531	441	500	493	379	461	484	407	499
	F2	990	879	1099	1083	1065	802	1019	1001	902	1260
/u;/	F1	471	498	431	437	487	366	386	409	407	450
	F2	836	887	1102	1011	1046	811	904	929	888	1127

4. ΔF1 dan ΔF2 for each participant.

Table 4 presents the differences (Δ) between the vowel values of American English as reported Hillenbrand et al. (1995) and the formant values of the participants. Positive ΔF1 readings signify increased openness in articulation or reduced tongue height, but negative ΔF2 values denote backing, indicating the tongue is positioned further back.

Tabel 4. ΔF1 and ΔF2 for Each Participant

Vowel		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
/iː/	ΔF1	129	-76	-86	-105	-70	14	76	15	71	1
	ΔF2	-7	-114	-61	-160	-118	-100	-56	-125	-161	-112
/ɪ/	ΔF1	-16	-29	140	-54	0	-13	-46	-57	-30	-25
	ΔF2	229	-242	460	-312	167	-107	-368	-37	229	-242
/ɛ/	ΔF1	59	-26	12	-18	102	-40	-93	-33	-21	63
	ΔF2	640	420	169	-375	258	92	97	152	33	235
/æ/	ΔF1	32	-162	96	3	-90	-40	-21	-65	-68	21
	ΔF2	386	-21	474	261	120	-236	-79	-17	-222	47
/ɑː/	ΔF1	-178	-115	-188	-160	71	-75	-155	17	38	106
	ΔF2	-534	-188	-372	-56	-72	-42	197	60	99	54
/ʌ/	ΔF1	83	321	56	-44	224	112	67	148	170	182
	ΔF2	-225	322	33	231	143	191	490	508	267	339
/ɔː/	ΔF1	233	-389	157	-321	-135	45	7	-25	43	146
	ΔF2	-321	-371	18	42	-172	-152	-92	-250	-116	-445
/ʊ/	ΔF1	46	72	-18	41	34	1	2	106	29	121
	ΔF2	-115	-226	-6	-22	-40	-195	22	4	-95	263
/uː/	ΔF1	-48	-21	-88	-82	-32	-103	-133	-60	-62	-19
	ΔF2	377	428	643	552	587	433	526	551	510	794

5. Vowel /i:/ - Vowel /u:/

In acoustic phonetics, a threshold (tolerance limit) is often used to determine whether a vowel production remains accurate or has deviated. According to prior research Park & Kim, (2023), subsequent thresholds are frequently employed; ±60 Hz for F1 (sensitive to vowel height) and ±200 Hz for F2 (responsive to frontness/backness). Production is considered accurate if the deviation (ΔF1 or ΔF2) remains within specified parameters. If it over the

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threshold, the vowel is categorised as shifted.

1. Vowel /iː/

The vowel /iː/ is a high, front, unrounded vowel. The acoustic targets for this vowel are F1: 342 Hz and F2: 2322 Hz for men, and F1: 437 Hz and F2: 2761 Hz for women. This target signifies that to articulate the vowel /iː/, the tongue should be positioned a high and front. The subsequent table present the formant frequency differences and tongue position values for vowel /iː/ in the word "key" across ten participants.

Tabel 5: Threshold analysis of vowel /iː/

Participant	ΔF1	ΔF2	Position	Shift
P1	129	-7	F1 > 60 = more open	[e] or [ɛ]
P2	-76	-114	F1 < -60 = closer	[ɪ]
P3	-86	-61	F1 < -60 = closer	[ɪ]
P4	-105	-160	F1 < -60 = closer F2 > -200= back	[ɪ]
P5	-70	-118	F1 > 60 = closer	[ɪ]
P6	14	-100	Accurate	
P7	-76	-56	F1 < -60 = more open	[e]
P8	15	-125	Accurate	
P9	71	-161	F1 > 60 = more open	[e]
P10	1	-112	Accurate	

The analysis table above shows that the realization of the vowel /iː/ by Dawan speakers (Amarasi dialect) leads to various forms of shifting:

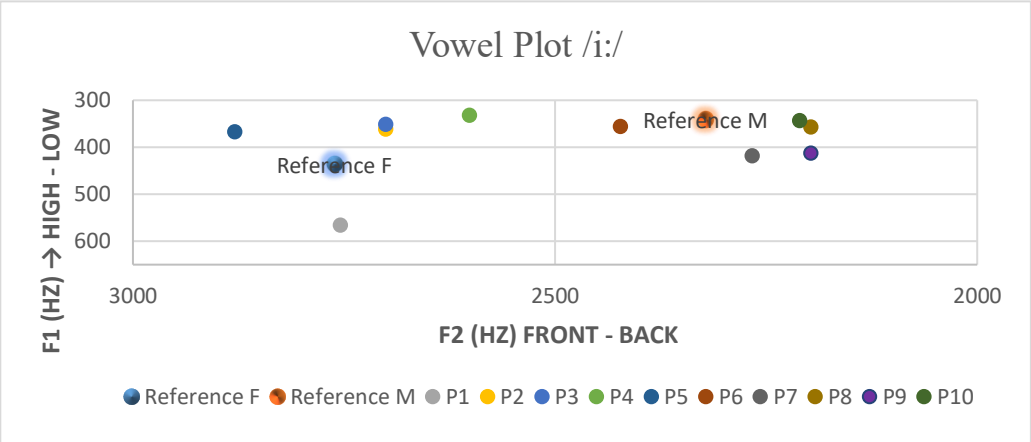
1. Shifting toward the more closed vowel [ɪ], this occurs when the negative value of ΔF1 surpasses the threshold value (60 Hz) at P2, P3, and P4. The increasing negative value of ΔF1 signifies that the tongue rises to a high and closed position.
2. Shifting toward the more open vowel [e]/[ɛ]. This occurs as the positive value of ΔF1 exceeds the threshold value (60 Hz) at P1, P7, and P9. It signifies that the tongue is positioned lower in an open state.
3. The vowel /iː/ was pronounced correctly in P6, P7, and P8. This occurs because the value between ΔF1 and ΔF2 does not exceed the threshold value.

The previously stated results and explanations indicate that, in general, speakers do not consistently preserve the vowel sound /iː/. The majority of shifts or interferences that occur include:

- /iː/ → [ɪ] This phenomenon is termed under-differentiation interference, as speakers struggle to differentiate vowel length.
- /iː/ → [e]/[ɛ] This represents a form of orthographic interference in which the term in the Dawan language (Amarasi dialect) is pronounced with the letter "e" and the known vowels [e] or [ɛ]. Consequently, although the intended English vowel is /iː/, speakers produce it with a

more open vowel, leading to a shift.

This is the F1 and F2 value plot for the /i:/ vowel articulated by each Dawan speaker (Amarasi dialect). This graph illustrates how each person's shift changes over time.



Plot 1. Threshold Analysis of Vowel /i:/

2. *Vowel /ɪ/*

The vowel /ɪ/ is characterized as a high, front, unrounded vowel. The acoustic targets F1 and F2 for men are 427 Hz and 2034 Hz, and for women are: 431 Hz and 2365 Hz. This target signifies that to articulate the vowel /ɪ/, the tongue should be positioned a little lower and slightly further back.

The table below presents the formant values and tongue positions for the word "*pin*" across ten participants.

Tabel 6. Threshold Analysis of Vowel /i:/

Partisipan	ΔF1	ΔF2	Posisi	Shift
P1	16	-229	F2 < -200 = back	[Y]
P2	29	242	F2 > 200 = front	[i:]
P3	-140	-460	F1 < - 60 =close F2 < 200 = back	[u:]
P4	54	312	F2 > 200 = front	[i:]
P5	-1	-167	Acurate	
P6	13	107	Acurate	
P7	46	368	F2 > 200= front	[i:]
P8	57	37	Acurate	
P9	-30	87	Acurate	
P10	25	-103	Acurate	

The analysis table above shows that the realization of the vowel /ɪ/ by Dawan speakers (Amarasi dialect) results in several forms of shifting.

1. Shifting toward the more front [i]. This occurs because the positive value of ΔF2 higher than the threshold value (200 Hz) at P2, P4, and P7.

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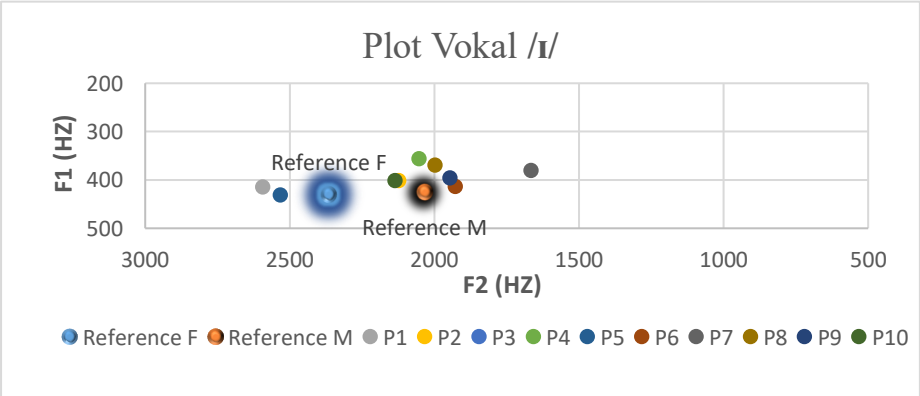
The increasing positive value of ΔF2 indicates that the tongue moves upwards to a front and open position.

2. Shifting toward the vowel [u:] which moves backward. This occurs because the negative value of ΔF1 is greater than the threshold value (60 Hz) and the value of ΔF2 exceeds the threshold value (>200) at P3. The increasing positive value of ΔF1 indicates that the tongue is more closed and the increasing ΔF2 indicates the tongue position is further back.
3. Shifting toward the more closed and back vowel [Y]. This occurs because the negative value of ΔF2 exceeds the threshold at P1. The increasing negative value of ΔF2 indicates the tongue position is slightly back.
4. The correct production of the vowel /ɪ/ at P6, P8, P9, and P10. This occurs because the difference between ΔF1 and ΔF2 does not exceed the threshold value.

The results and explanations above show that, overall, speakers do not consistently maintain the vowel sound /ɪ/. The majority of shifts or interferences that occur include:

- /ɪ/ → [i] this is called under-differentiation interference because speakers have difficulty distinguishing vowel length.
- /ɪ/ → [u] or [Y] this shift is part of substitution interference because speakers replace the vowels present in the inventory of the Amarasi dialect.

Here are the F1 and F2 values of the vowel /ɪ/ produced by each Dawan speaker (Amarasi dialect). This plot shows the variation in each individual's shift.



Plot 2. Threshold Analysis of Vowel /ɪ/

3. *The Vowel /ɛ/*

Vowel /ɛ/ is a front-mid, unrounded vowel. This vowel has acoustic targets for men, which are F1: 580 Hz and F2: 1799 Hz, while the acoustic

targets for women are F1: 731 and F2: 2058 Hz. The table below shows the formant values and tongue positions for the word "net" in ten participants.

Tabel 7: Threshold Analysis of Vowel / ɛ/

Partisipan	ΔF1	ΔF2	Position	Shift
P1	-59	-640	F2 < -200 = back	[ɜ]
P2	26	-420	F2 < -200 = back	[ɜ]
P3	-12	-169	Accurate	
P4	18	375	F2 > 200 = front	[e]
P5	-102	-258	F1 < -60 = close F2 < -200 = back	[ɘ]
P6	40	-92	Accurate	
P7	-58	-97	Accurate	
P8	33	-152	Accurate	
P9	21	-33	Accurate	
P10	-63	-235	F1 < -60= close F2< -200 = back	[ɘ]

The analysis table above indicates that the articulation of the vowel /ɛ/ by Dawan speakers (Amarasi dialect) leads to various forms of shifting.

1. Transitioning towards the back-vowel [ɜ]. This occurs because the negative value of ΔF2 surpasses the threshold value (200 Hz) at P1 and P2. The escalating negative value of ΔF2 signifies that the tongue is moving posteriorly.
2. Transitioning to the front vowel [e]. This happends because the positive value of ΔF2 surpasses the threshold value (>200) at P4. The rising positive result of ΔF2 signifies that the tongue is positioned more forward.
3. Shifting towards the more closed and retracted vowel [ɘ]. This transpires due to the negative values of ΔF1 and ΔF2 surpassing the threshold at P5 and P10. This suggests that the tongue position is further back, inclined towards the vowel [ɘ].
4. Accurate articulation of the vowel /ɛ/ at P3, P6, P7, P8, and P9. This transpires as the value of ΔF1 and ΔF2 remains below the threshold value.

The results and explanations above show that, in general, speakers do not consistently preserve the vowel sound /ɛ/. The major shifts or interferences observed are:

- /ɛ/ → [ɜ], /ɛ/ → [e], and /ɛ/ → [ɘ], which exemplify interference under-differentiation due to speakers' inability to differentiate vowel quality, leading them to perceive these variants as identical.

The subsequent plot illustrates the distribution of vowel realizations and the directional displacement from the target vowel across ten participants.

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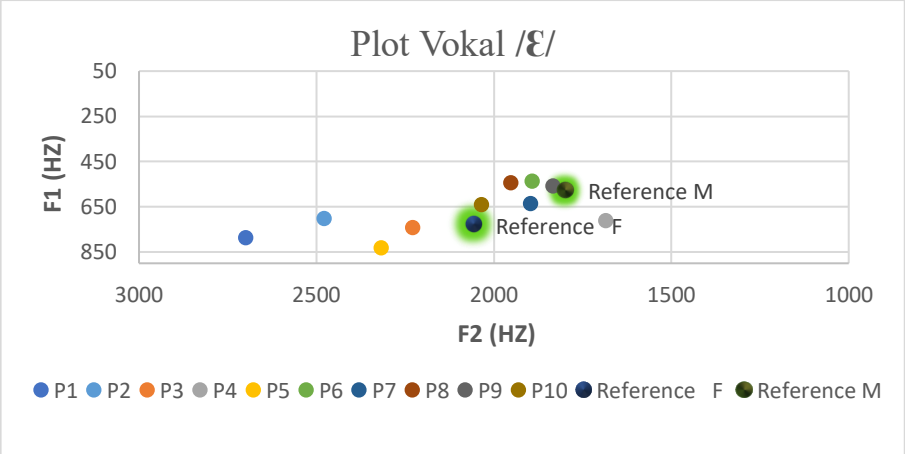


Plot 3. Threshold Analysis of Vowel /ɛ/

4. Vowel /æ/

Vowel /æ/ is an open-mid, unrounded vowel. This vowel has acoustic targets for men, which are F1: 588 Hz and F2: 1952 Hz, while the acoustic targets for women are F1: 669 and F2: 2349 Hz. The table below shows the formant values and tongue positions for the word "cat" in ten participants.

Tabel 8. Threshold analysis of vowel / æ/

Participant	ΔF1	ΔF2	Posisition	Shift
P1	32	-386	F2 < -200 = back	[ʌ]
P2	162	-21	F1> 60 = open	[a]
P3	96	474	F1> 60 =open F2> 200 = front	[ɛ]
P4	3	261	F2 > 200 = front	[ɛ]
P5	-90	120	F1 < -60 =close	[e]
P6	-40	-236	F2 < -200 =back	[ʌ]
P7	-21	-79	Accurate	
P8	-65	-17	F1 < -60 =close	[e]
P9	-68	-222	F1 < -60 = open F2 < -200 =back	[ʌ]
P10	21	47	Accurate	

The analysis table above shows that the realization of the vowel /æ/ by Dawan speakers (Amarasi dialect) leads to several forms of shifting.

1. Shifting toward the more retracted vowel [ʌ]. This occurs because the negative value of ΔF2 exceeds the threshold value (200 Hz) at P1, P6, and P9. The increasing negative value of ΔF2 indicates that the tongue is moving backward.
2. Shifting toward the more open vowel [a]. This occurs because the

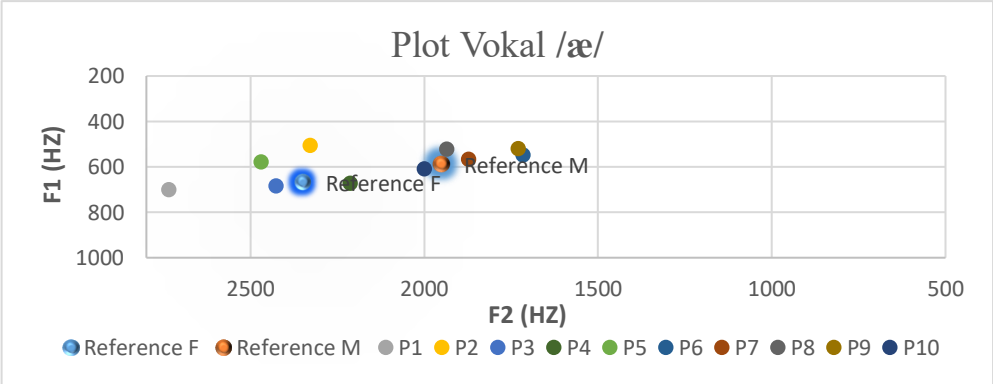
positive value of ΔF1 exceeds the threshold value (>60) at P2. The increasing positive value of ΔF1 indicates that the vowel is more open.

3. Shifting toward the more open and front vowel [ɛ]. This occurs because the positive values of ΔF1 and ΔF2 exceed the threshold at P3 and P4. This indicates a more open and front tongue position.
4. Shifting toward the more front and closed vowel [e], as indicated by the negative value of ΔF1 exceeding the threshold at P5 and P8, resulting in an open and front vowel. 4. Accurate production of the vowel /æ/ at P7 and P10. This occurs because the difference between ΔF1 and ΔF2 does not exceed the threshold value.

The results and explanations above show that overall, speakers do not consistently maintain the vowel sound /æ/. The majority of shifts or interferences that occur include:

- /æ/ → [ʌ] is part of a reinterpretation because speakers interpret the vowel sound /æ/ as the vowel [ʌ] due to unfamiliarity with that vowel.
- /æ/→[a], [æ] → [ɛ], and [æ]→[e] are part of substitution interference because the vowel inventory /æ/ is not present in the Dawan language (Amarasi dialect), so speakers replace it with a vowel that is closer to the Dawan language vowel.

The subsequent plot illustrates the distribution of vowel realizations and the direction of shift towards the target vowel by ten participants.



Plot 4: Threshold Analysis of Vowel /æ/

5. *Vowel /ʌ/*

The vowel /ʌ/ is classified as a low, back, rounded vowel. The acoustic objectives for this vowel are F1: 623 Hz and F2:1200 Hz for men, and F1: 753 Hz and F2: 1426 Hz for women. The table below presents the formant values and tongue placements for the word "gun" across ten participants.

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Table 9. ΔF1 and ΔF2 Values of the Vowel /ʌ/

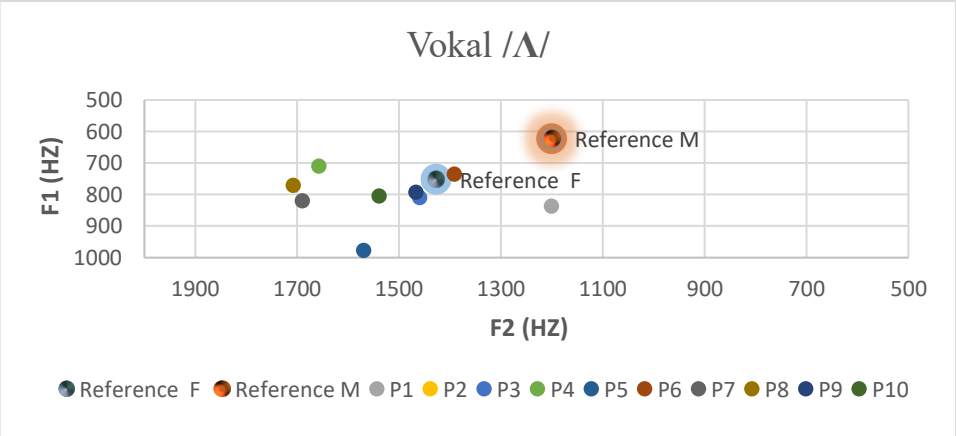
Participant	ΔF1	ΔF2	Position	Shift
P1	83	-225	F1 > 60 =open F2 < -200 = backward	[ɑ]
P2	321	322	F1 > 60 = open F2 > 200 = forward	[a]
P3	56	33	Accurate	
P4	-44	231	F2 > 200 = forward	[ɐ]
P5	224	143	F1> 60 = open	[a]
P6	112	191	F1 > 60 = open	[a]
P7	67	490	F1 > 60 = open F2 > 200 = forward	[ɐ]
P8	148	508	F1 > 60 = open F2 > 200 = forward	[æ]
P9	170	267	F1 > 60 = open F2 > 200 = forward	[a]
P10	182	339	F1 > 60 = open F2 > 200 = forward	[a]

The analysis table above shows that the realization of the vowel /ʌ/ by Dawan speakers (Amarasi dialect) results in several forms of shifting.

1. Shifting toward the more front and open vowel [ɑ]. This occurs because the positive value of ΔF1 exceeds the threshold value (60 Hz) and the negative value of F2 exceeds the threshold value (200 Hz) at P1. The increasing positive value of ΔF1 indicates that the tongue rises to a front position, and the negative value of ΔF1 indicates a more open vowel.
2. Shifting toward the vowel [a], which is an open and front vowel. This occurs because the positive values of ΔF1 and ΔF2 exceed the threshold values at P2, P5, P6, P9, and P10. The increasing positive value of ΔF1 indicates that the tongue rises more, making it open, and the increasing value of ΔF2 indicates a more retracted tongue position.
3. Shifting toward the more closed and back vowel [ɐ]. This occurs because the positive value of ΔF2 exceeds the threshold at P4. This indicates that the tongue position rises forward.
4. Shifting toward the more open and front vowel [æ]. This occurs because the positive values of ΔF1 and ΔF2 exceed the threshold values. This results in a very open and front vowel.
5. Correct production of the vowel /ʌ/ at P3. This occurs because the difference between ΔF1 and ΔF2 does not exceed the threshold value.

The results and explanations above show that overall, speakers do not consistently maintain the vowel sound /ʌ/. The majority of shifts or interferences that occur include:

/ʌ/ → [ɑ], /ʌ/ → [a], /ʌ/ → [ɐ], and ʌ/ → [æ], which are types of under-differentiation interference where speakers only have the vowel /a/, so when speakers pronounce this vowel /a/, variations such as the vowels [ɑ], [ɐ], and [æ] occur. The following plot shows the distribution of vowel realizations and the direction of shift from the target vowel by ten participants.



Plot 5. Threshold Analysis of Vowel /ʌ/

6. Vowel /a:/

The vowel /ɑ:/ is classified as a low, back, rounded vowel. The acoustic objectives for this vowel are F1: 786 Hz and F2: 1333 Hz for men, and F1: 936 Hz and F2: 1551 Hz for women. The table below presents the formant values and tongue placements for the word *"half"* across ten participants.

Tabel 10. ΔF1 and ΔF2 Values of the Vowel [a:]

Participant	ΔF1	ΔF2	Position	Shift
P1	-178	-534	F1< -60 = closed F2 < -200 = back	[o]
P2	-115	-188	F1< -60 = close	[o]
P3	-188	-372	F1< -60 = closed F2 < -200 = back	[o]
P4	-160	-56	F1< -60 = closed	[o]
P5	71	-72	Accurate	-
P6	-75	-42	Accurate	-
P7	-155	197	F1 < -60 = closed	[e]
P8	17	60	Accurate	-
P9	38	99	Accurate	-
P10	106	54	F1> 60 = open	[a]

The analysis table above indicates that the articulation of the vowel /ɑ:/ by Dawan speakers (Amarasi dialect) leads to various forms of shifting.

1. Transitioning to the semi-closed and back vowel [o]. This transpires due to the positive value of ΔF1 surpassing the

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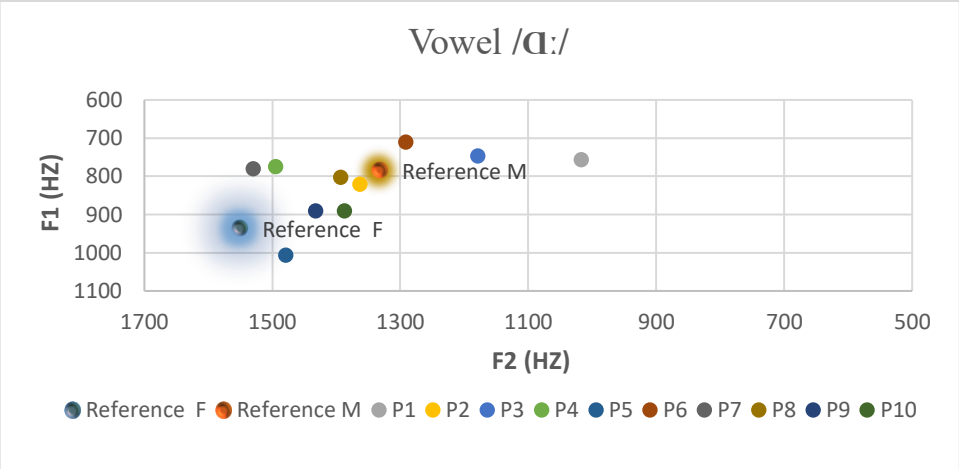
threshold (60 Hz) and the positive value of F2 beyond the threshold (200 Hz) at P1, P2, P3, and P4. The escalating positive value of ΔF1 signifies that the tongue elevates to the anterior position, while the positive value of ΔF2 denotes that the vowel transitions farther towards the posterior.

2. Transitioning to the vowel [e], characterized as a closed and front vowel. This transpires as the positive value of ΔF1 surpasses the threshold value at P5. The escalating positive value of ΔF1 signifies that the tongue elevates farther, resulting in its opening.
3. Transitioning towards the more open and front vowel [a]. This transpires due to the positive value of ΔF2 surpassing the barrier at P10. This signifies that the tongue's location elevates anteriorly.
4. Transitioning to the more open and front vowel [ae]. This transpires as the positive values of ΔF1 and ΔF2 surpass the threshold values. This produces a highly open and frontal vowel.
5. Accurate articulation of the vowel /ɑː/ at P5, P6, P8, and P9. This transpires as the disparity between ΔF1 and ΔF2 remains below the threshold value.

The aforementioned observations and explanations indicate that, in general, speakers do not consistently preserve the vowel sound /ɑː/. The predominant shifts or interferences observed include:

- The vowel /ɑː/ is substituted with [o] in the Dawan dialect of Amarasi due to the absence of /ɑː/ in its vowel inventory, resulting in replacement interference by the speakers.
- /ɑː/ → [æ], indicative of reinterpretation, as speakers misconstrue the sound within the English phonetic inventory, so generating a novel sound.
- /ɑː/ → [e], indicating a form of substitution interference wherein speakers substitute the vowel sound in English with that of their native language.

The subsequent plot illustrates the distribution of vowel realizations and the shift direction from the target vowel among ten participants.



Plot 6. Threshold Analysis of Vowel /a:/

7. Vowel /ɔ:/

The vowel /ɔ:/ is characterized as a back half-open, rounded vowel. The acoustic objectives for this vowel are F1: 652 Hz and F2: 997 Hz for men, and F1: 781 Hz and F2: 1136 Hz for women.The table below presents the formant values and tongue placements for the word "maul" across ten participants.

Tabel 11. ΔF1 and ΔF2 Values of the Vowel /ɔ:/

Participant	ΔF1	ΔF2	Position	Shift
P1	-233	321	F1< -60 = close F2 > 200 = front	[e]
P2	389	371	F1> 60 = open F2 > 200 = front	[a]
P3	-157	-18	F1< -60 = close	[ɔ:]
P4	-214	-42	F1< -60 = close	[o]
P5	135	172	F1> 60 = open	[ɒ]
P6	-174	-152	F1< -60 = close	[o]
P7	-7	92	Accurate	-
P8	25	250	F2 > 200 = front	[ɛ]
P9	43	116	Accurate	-
P10	146	448	F1> 60 = open F2 > 200 = front	[a]

The study table above indicates that the articulation of the vowel /ɔ:/ by Dawan speakers (Amarasi dialect) results in various sorts of shifts:

1. The shift to the vowel [ɒ], a half-open back vowel, happens when a positive ΔF1 value above the threshold of 60 Hz in P5. This alteration signifies that the tongue position is comparatively elevated and more anterior.
2. A transition to the vowel [a], an open front vowel, occurs when both ΔF1 and ΔF2 are positive and surpass the threshold values in P2 and

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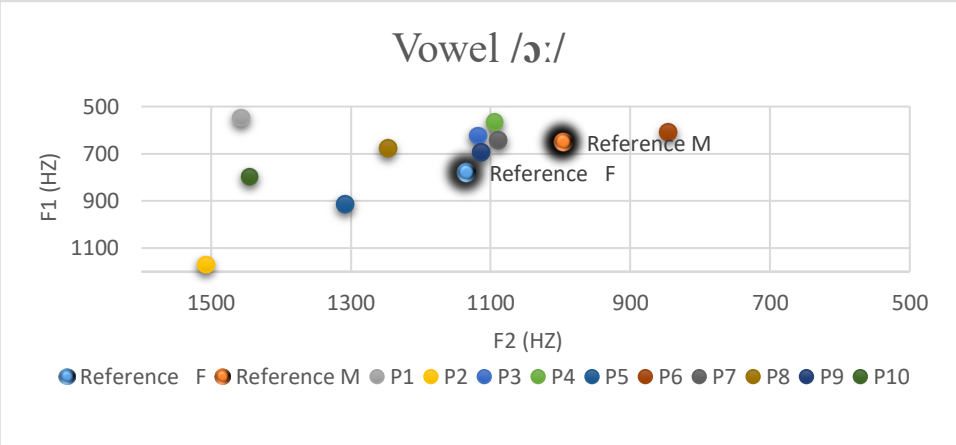
P10. This indicates that the tongue position is more anterior.

3. A transition to the vowel [e], a close front vowel, occurs when negative ΔF1 and ΔF2 values surpass the threshold in P1. This signifies that the tongue advances and elevates.
4. A transition to the vowel [o], a half-close back vowel, occurs when negative ΔF1 and ΔF2 values surpass the threshold in P4 and P6. This indicates that the tongue is marginally dropped and retracted, resulting in the vowel [o].
5. The accurate production of the vowel /ɔː/ is observed in P3 and P9, as the ΔF1 and ΔF2 variations remain below the threshold values.

The findings and explanations presented above indicate that, in general, the speakers do not consistently produce the English vowel /ɔː/. The predominant shifts or interferences identified are as follows:

- /ɔː/ → [ɒ] and /ɔː/ → [a] exemplify reinterpretation, wherein speakers misinterpret an English vowel sound and generate a new one.
- /ɔː/ → [e] denotes substitution interference, wherein the English vowel is replaced by a vowel from the speakers' native language.
- /ɔː/ → [o] is categorized as under-differentiation interference, as the speakers replace the English vowel /ɔː/, absent in their L1 vowel inventory, with [o], which is present in their L1.

The subsequent plot depicts the distribution of vowel realizations and the trajectories of shifts from the target vowel among the ten participants.



Plot 7. Threshold Analysis of Vowel /ɔː/

8. Vowel /ʊ/

The vowel /ʊ/ is classified as a back half-open, rounded vowel. The acoustic objectives for this vowel are F1: 378Hz and F2: 997 Hz for men, and

F1: F1: 459 Hz and F2: 1105 Hz for women. A threshold value is employed to assess if a vocal production has moved or remains accurate in the analysis of vowel shifts. The table below presents the formant values and tongue placements for the word "look" across ten participants.

Table 12 ΔF1 and ΔF2 Values of the Vowel /ʊ/

Participant	ΔF1	ΔF2	Position	Shift
P1	46	-115	Accurate	-
P2	72	-226	F1 > 60 = open F2 < -200 = back	[u]
P3	-18	-6	Accurate	-
P4	41	-22	Accurate	-
P5	34	-40	Accurate	-
P6	1	-195	Accurate	-
P7	2	22	Accurate	-
P8	106	4	F1> 60 = open	[ɔ]
P9	29	-95	Accurate	-
P10	121	-263	F1> 60 = open F2 < -200 = back	[u]

The analysis table above reveals that speakers of the Dawan language (Amarasi dialect) realize the vowel /ʊ/ in a number of different ways:

1. Moving to the open and back vowel [u] because the positive ΔF1 value is higher than the threshold value (60 Hz) and the negative ΔF2 value is higher than the threshold value (200 Hz) at P1 and P10. These two alterations show that the tongue is open and back.
2. Moving to the open and somewhat back vowel [ɔ]. This happens because the positive values of ΔF1 and ΔF2 are greater than the threshold value at P8. This signifies that the tongue is more open and pushed back.
3. Proper production of the vowel /ʊ/ at P1, P3, P4, P5, P7, and P9. This happens because the differential values ΔF1 and ΔF2 are not more than the threshold value.

The information and results above reveal that, in general, speakers don't keep the vowel sound /ʊ/. Most of the changes or problems that happen are:

When speakers substitute the vowel sound in English with a sound from their native language, they are using substitution interference. For example, /ʊ/ → [u] and /ʊ/ → [ɔ].

The following graphic shows how 10 people realized the vowels and how they shifted from the intended vowel.

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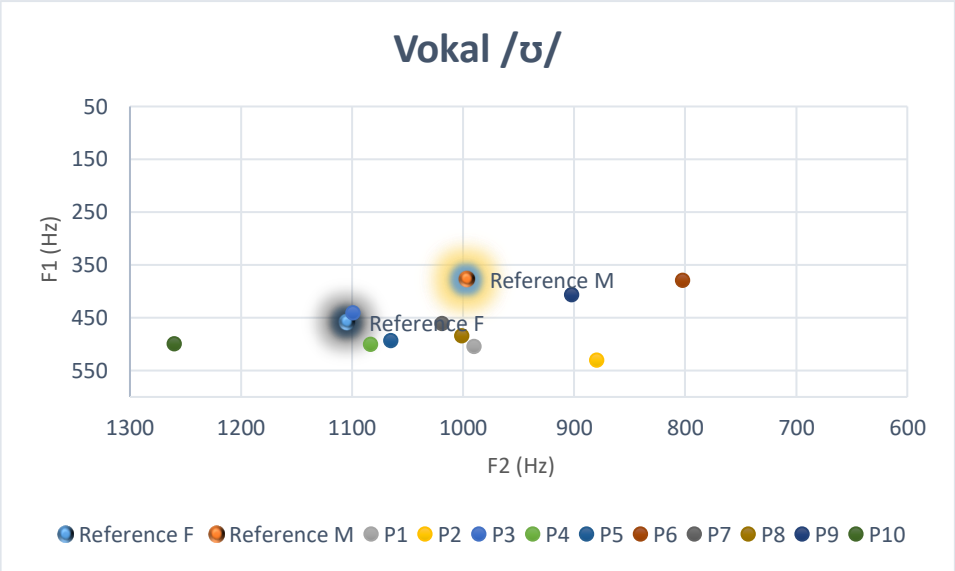


Plot 8. Threshold Analysis of Vowel /ʊ/

9. Vowel /u:/

The vowel /u:/ is defined as half-open, back, and rounded. The acoustic targets for this vowel are F1: 469 Hz and F2: 378 Hz for males, and F1: 519 Hz and F2: 459 Hz for females. The table below presents the formant frequency differences value (Δ) and tongue placements for the word "blue" across ten participants.

Table 13 ΔF1 and ΔF2 Values of the Vowel

Participant	ΔF1	ΔF2	Position	Shift
P1	-48	377	F2 > 200 = front	[ʉ]
P2	-21	428	F2 > 200 = front	[ʉ]
P3	-88	643	F1< -60 = close F2 > 200 = front	[ʉ] or [y]
P4	-82	552	F1< -60 = close F2 > 200 = front	[ʉ]
P5	-32	587	F2 > 200 = front	[ʉ]
P6	-103	433	F1< -60 =close F2 > 200 = front	[ʉ]
P7	-133	526	F1< -60 = close F2 > 200 = front	[ʉ]
P8	-60	551	F2 > 200 = front	[ʉ]
P9	-62	510	F1< -60 = close F2 > 200 = front	[ʉ]
P10	-19	749	F2 > 200 = front	[ʉ] or [y]

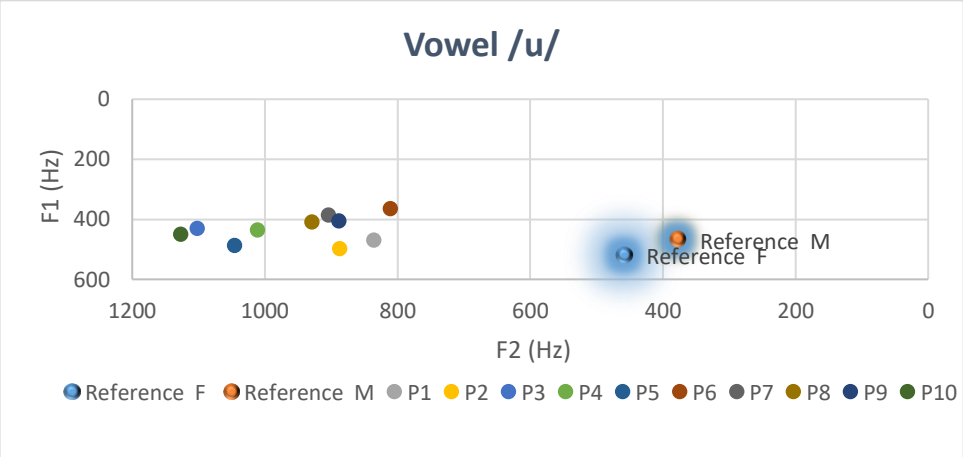
The analysis table above indicates that Dawan speakers (Amarasi dialect) exhibit various forms of shifts in the realization of the vowel /u:/.

1. Transitioning to the near-central rounded vowel [ʉ]. Generally, according to the values of ΔF1 and ΔF2, the shift is situated between the two places (ʉ) and (y), as the substantial positive value of ΔF2 surpasses the threshold (200 Hz) for all individuals.
2. The /u/ vowel was not precisely articulated by all individuals. The previously mentioned results and explanations indicate that, in general, speakers tend to neglect the vowel sound /ɑː/.

The predominant shifts or interferences that manifest include:

- /u/ → [ʉ], representing a substitution interference wherein speakers replace the vowel sound found in English with that of their native language.

The following graphic displays the distribution of vowel realizations and the directional deviation from the target vowel among ten participants.



Plot 9: Threshold analysis of vowel /u/

6. Comparison Between Target Values and Participants' Production

The subsequent graph illustrates the typical acoustic distribution of English target vowels. This serves as a benchmark for examining how speakers of Dawan (Amarasi dialect) articulate English vowels in their speech.

The subsequent graphic represents the average acoustic distribution of the vowel sounds by the participants. This image facilitates comparison with the English target vowels, emphasizing potential shifts and patterns of interference.

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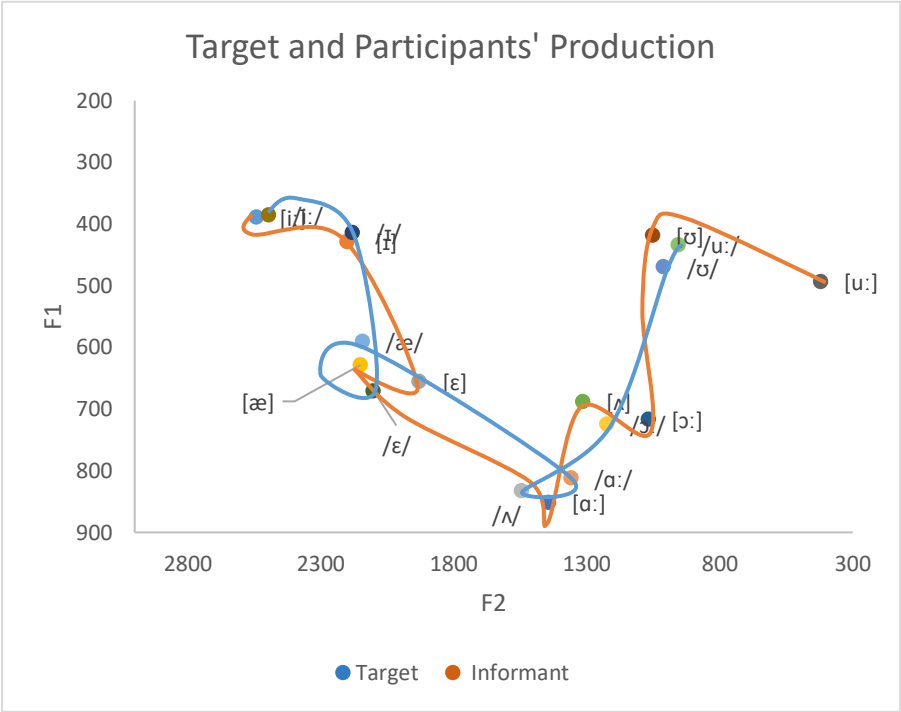

Plot 10. Target and Participants' Production

The diagram above illustrates the contrast between the English target vowels and the realizations produced by Dawan-speaking participants (Amarasi dialect). The results reveal a consistent pattern of phonological interference in the participants' vowel articulation. Three primary categories of interference were identified: substitution, under-differentiation, and reinterpretation. Substitution occurs when the target vowels lack direct equivalents in the Dawan vowel system, exemplified by the realization of /iː/ as [ɪ] and /ʌ/ as [a]. Under-differentiation observed in vowel pairs like /e/–[ae] and /ɑː/–[ɔː], which, despite having distinct acoustic characteristics, are articulated by the participants with less acoustic separation, leading to the loss of their phonological contrast. Reinterpretation, on the other hand, reflect the influence of Dawan vowel system, which lack tense-lax distictions and other contrasts present in English. This is seen in the articulation of /uː/ and /ʊ/, which are generated more anteriorly, resembling [ʉ].

These results suggest that Amarasi speakers tend to simplify the English vowel system, providing unequivocal evidence of cross-linguistic phonological interference.

7. Conclusion and Suggestion

This study concludes that speakers of the Dawan language (Amarasi dialect) consistently experience phonological interference when producing English vowels. Three primary categories of interference were recognized:

substitution, under-differentiation, and reinterpretation.

Acoustic analyses of F1 and F2 revealed that numerous vowel articulations deviations from English targets, particularly for /iː/, /ae/, /ʌ/, /ɑː/, and /uː/. These variances indicate systematic variations in tongue height, tongue frontness, and lip rounding, influenced by the restricted vowel inventory of the Amarasi dialect, which comprises only five vowels. The findings highlight the significant impact of L1 phonology on L2 pronunciation and indicate that focused pronunciation training is necessary to address these difficulties.

In considering the results mentioned above, some recommendations might be articulated as follows:

Dawan (Amarasi dialect) speakers are advised to undertake pronunciation training that focuses on articulatory features, like tongue height and tongue advancement, to more accurately achieve English vowel objectives. Employing acoustic software like *Praat* enables learners to visualize and modify their speech through formant feedback.

This study's findings can assist English teachers in creating contrastive phonetic instructional materials that emphasize the distinctions between the English and Dawan vowel systems. Integrating auditory or visual pronunciation training such as spectrogram or vowel plot demonstrations can enhance learners' phonological awareness and boost vowel discrimination.

Future scholars are advised to broaden their analytical scope to encompass consonantal and prosodic interference, so offering a more comprehensive view of the Dawan language's impact on English pronunciation. Future research may encompass a greater number of individuals representing diverse Dawan dialects to investigate wider phonological variance.

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