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THE ACOUSTICS OF GENDER AND REGIONAL VARIATION IN PAKISTANI ENGLISH: A SOCIOPHONETIC ANALYSIS OF LONG OPEN MONOPHTHONG [A:]

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Abstract

This study examines the acoustic recognition of the long open vowel /a:/ in thirteen regional varieties of Pakistani, with specific consideration to gender-based and regional disparities. Grounded on speech data from 208 undergraduate speakers (including 104 females, 104 males), the study uses formant analysis (F1 and F2), vowel duration, z-score normalization, and inferential statistics to analyze how vowel quality and duration differ across Pakistan. Vowel segments were automatically time-aligned employing the Montreal Forced Aligner (MFA), following acoustic extraction via custom-written PRAAT scripts. The findings expose strong gender impacts, with female speakers articulating more open and centralized productions, whereas male speakers display greater regional disparity, especially in duration and vowel backness. Regional trends further highlight substratal impact from local languages; for instance, Sindhi, Saraiki, Pashto, Balochi, and Shina. The emerging patterns validate that /a:/ serves as a sociophonetic marker of both regional and gender identity in Pakistani English, supporting the pluricentric property of this postcolonial English variety.

Keywords: *Pakistani English, vowel acoustics, /a:/, sociophonetics, gender variation, Montreal Forced Aligner, regional dialects*

1. Introduction

The contact with local languages, the local sociolinguistic ecologies and changing norms of English usage in education and government have led to the development of Pakistani English (PakE) as a postcolonial form of English, which is widely disseminated and widely used in the country (Rahman, 1990, 2002; Baumgardner, 1993; Schneider, 2007). The phonological variation can serve as a sensitive doorway to these processes, especially vowel system, which is extremely sensitive to substratal influence as well as sociophonetic constraints (Foulkes & Docherty, 2006; Johnson, 2020).

The long low vowel /a:/ is particularly salient as an English vowel because of its open articulation, temporal manifestation, and cross-linguistic variation. This vowel, in South Asian Englishes, is often not coincident with Inner Circle norms, and is influenced by Indo-Aryan and local phonological systems promoting low, back and extended realizations of this vowel (Bansal, 1969; Sailaja, 2009; Wiltshire & Harnsberger, 2006). The impressionistic descriptions suggest similar tendencies in Pakistani English; nevertheless, the presence of sizeable acoustic results on an interregional and gender basis is underrepresented (Mahboob & Ahmar, 2004; Rahman, 2011).

The paper provides an acoustic survey of /a:/ in thirteen regional dialects of Pakistani English, answering the following research questions:

1. How does the acoustic realization of /a:/ differ in regional varieties of Pakistani English?
2. What role does gender play in determining vowel backness, height, and duration?
3. To what extent do regional and gender effects interact in shaping vowel variation?

2. Historical Background

The study of World Englishes establishes that contact induced change, identity formation, and stratification by the sociolinguistic structure determine the phonological systems in postcolonial varieties (Kachru, 1992; Schneider, 2007). In a similar vein, vowel quality tends to reveal transfer of substrate language in addition to accommodation of prestige standards relating to global English (Kortmann & Schneider, 2004).

The South Asian Englishes have always been reported to support and lengthen the low vowels, due to the influence of languages like Hindi-Urdu, Punjabi, Sindhi, and Bengali (Bansal, 1969; Wiltshire & Harnsberger, 2006; Sailaja, 2009). Indian English acoustic studies reveal that /a:/ is placed in a low-back position on the vowel space and covers strong duration differences with British English (Maxwell & Fletcher, 2010; Sirsa & Redford, 2013).

The early descriptive work on Pakistani English that defined PakE as a systematic variety, as opposed to a learner interlanguage, was carried out by Rahman (1990, 2002) and Baumgardner (1993). Later phonological research has reported the reorganization of the vowel system, such as decreased diphthongization and supported length contrasts (Mahboob & Ahmar, 2004; Shabbir & Bughio, 2016). Nonetheless, the majority of Pakistani research depends on small samples of speakers or an impressionistic examination, and there is no research on regional and gender-based acoustic variation.

On sociophonetic account, gender has been demonstrated to be pivotal in vowel production. Female speakers constitutively manifest more peripheral and consistent vowel realizations whereas their male counterparts tend to be more regionally differentiated and phonetically variable (Labov, 2001; Eckert & McConnell-Ginet, 2013; Johnson, 2020). These patterns have been observed in all the varieties of English and are gradually being understood as the result of both physiological and social indexing (Foulkes et al., 2010).

The current paper incorporates these local and global insights by analyzing the role of /a:/ as a sociophonetic gender and geographical marker of Pakistani English.

3. Methodology

3.1 Research Design and Participants

The proposed study embraces a descriptive and experimental research design within the theoretical model of experimental phonology to examine the vocalic phonology of Pakistani English with close interest to the production of monophthong vowel. The descriptive part records the systematic distributions of vowel realizations, whereas the experimental part uses controlled acoustic measures in order to quantify the difference in vowel quality and duration.

A total of 208 undergraduate speakers were selected (including 104 males and 104 females) so that the gender ratios were equal. The sample size consisted of thirteen (13) cities that represented all six (6) major geographical areas in Pakistan, namely, Punjab, Sindh, Khyber Pakhtunkhwa, Balochistan, Gilgit-Baltistan, and Azad Jammu & Kashmir, and the Islamabad Capital territory (ICT). The geographically stratified sampling design covers a wide area of region while remaining comparable across groups of speakers.

Each respondent was a native speaker of the area and had studied English formally, to be functionally proficient in Pakistani English. The limitation of the sample to undergraduate speakers reduced the effect of age and education on the sample, enabling more direct analysis of the impact of the regions and gender-based phonetic impacts.

3.2 Materials and Procedures

Target vowels were obtained through isolated word-list reading tasks. The audio was recorded in quite environments with good quality digital tape recorders and head-mounted microphones. All the recordings were digitized at the standard sampling rate and then analyzed with established acoustic analysis software.

The Montreal Forced Aligner (MFA) was used to complete segmental annotation and gave automatic phone-level time alignment of the orthographic transcription to speech signals. The resulting Text Grids were manually checked in order to provide accuracy to aligning vowel boundaries.

Custom-written PRAAT scripts provided acoustic data, resulting in the automatic calculation of F1 and F2 values at the temporal midpoint of each /i:/ the token, and vowel duration. Midpoint measurement was selected in order to reduce the coarticulatory effects of adjoining consonants.

The statistical processes involved descriptive statistics, two-way ANOVA with Region and Gender as fixed variables and Tukey HSD post-hoc tests to define the significant inter-regional differences. Standard statistical software was used to do all analyses.

3.3 Acoustic Measurements and Normalization

The vowel /a:/ was examined for:

- Formant -I exhibiting vowel height and openness
- Formant-II exhibiting vowel backness and frontness
- Duration (given in ms)

All the acoustic values were z-score normalized between male and female speakers to eliminate the effects of physiological differences between speakers. This normalized process ensured that differences in what was observed were due to linguistic and sociophonetic variation and not due to anatomy.

4. Results

This section offers a description of spectral (F1, F2) and temporal (duration) properties of the vowel /i:/ in thirteen regional variants of Pakistani English with a clear focus on gender-related tendencies and statistical results.

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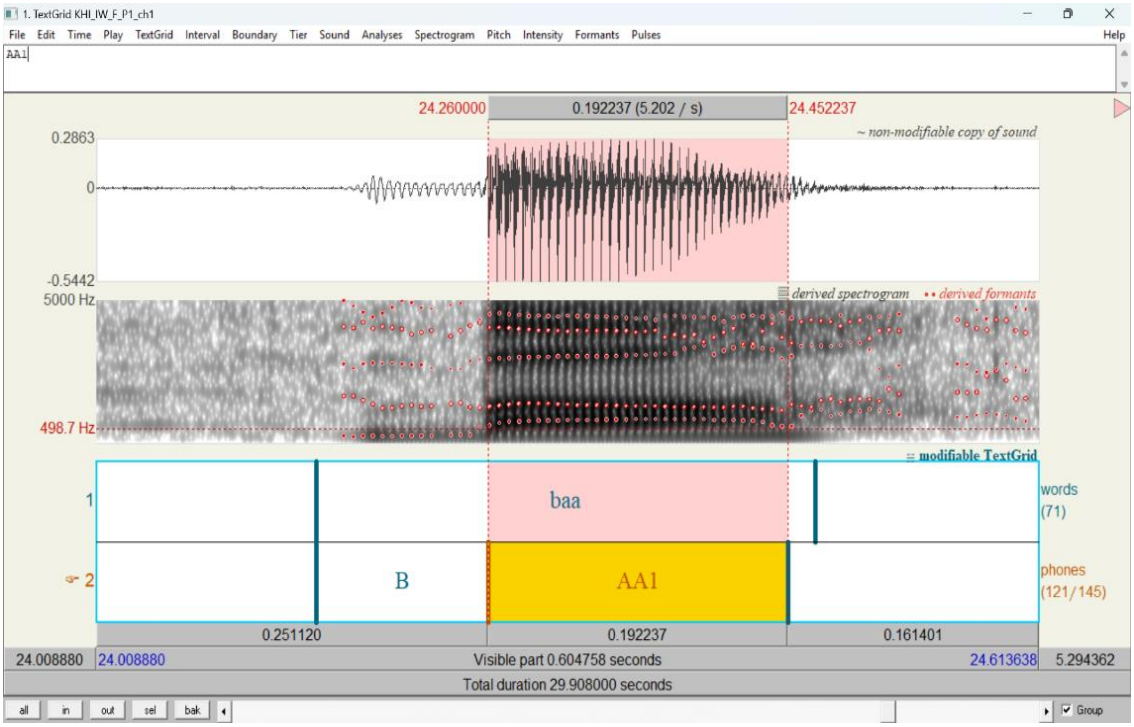

Figure 1
Image showing a PRAAT Spectrogram and Waveform of /a:/ for the Word "baa" Produced by a KHI Female Speaker of PakE, as Read in the Wordlist Reading Task

4.1 Mean Acoustic Values of /a:/ Across Regions and Gender

The systematic gender-based and regional variation in the mean formant values of /a:/ in thirteen varieties of Pakistani English is observed. The F1 values of female speakers are consistently higher than that of male speakers, indicating more open productions of the vowels. The most open productions are realized in Sukkur (SKR), Multan (MUL) and Gilgit (GLT), with relatively fewer open realizations in Khuzdar (KHD) and Quetta (QUE). Table 1 shows the average F1 and F2 values (Hz) in all regions of male and female speakers.

Table 1
Mean F1 and F2 Values (Hz) for /a:/ Across 13 Varieties of Pakistani English (Male vs. Female)

Gender	Measure	ABT	GLT	ISB	KHD	KHI	LHR	MRP	MUL	MZB	PSH	QUE	SKD	SKR
Female	F1 mean	733	770	758	716	725	739	720	773	745	712	705	740	801
Female	F2 mean	1273	1359	1255	1299	1282	1204	1362	1304	1256	1296	1192	1334	1299
Male	F1	670	617	656	608	685	675	685	619	676	654	640	628	700

	mean													
Male	F2 mean	1257	1282	1234	1238	1317	1588	1268	1211	1376	1285	1351	1298	1433

As displayed in Figure 1, the female speakers are consistently higher (≈720–800 Hz) and the male speakers are lower (≈610–690 Hz), showing that there is a strong gender effect on vowel height.

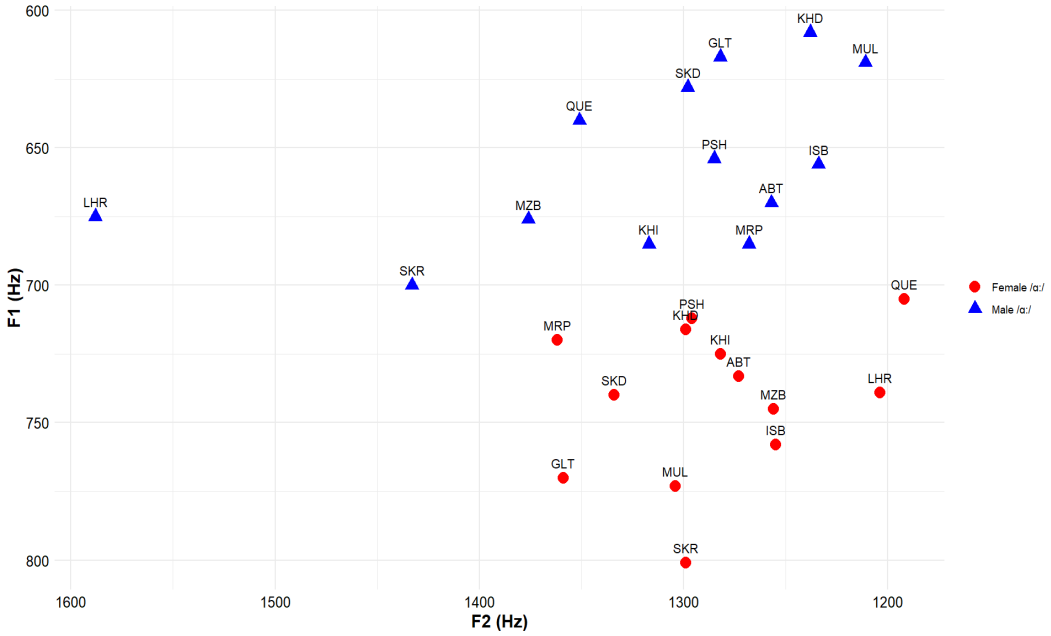

Figure 2
Mean F1 and F2 Values for /a:/ Across 13 Regions (Male vs. Female)

4.2 Z-Score Normalized Acoustic Patterns

To minimize the possibility of physiological variations; F1 and F2 scores were z-score normalized among male and female speakers. The normalized output supports the raw acoustic results and makes an inter-regional comparison. Table 2 shows z-score values of F1, F2 and duration at all regions normalized.

Female speakers display consistently high positive F1 z-scores (e.g., SKR = 1.361; MUL = 1.137), signifying higher openness while male speakers demonstrate lower values of the z-score which reflects a higher tongue position. Both genders present negative F2 z-scores, which proves a strong support of /a:/ in Pakistani English. Figure 2 illustrates these normalized patterns in the F1-F2 vowel space.

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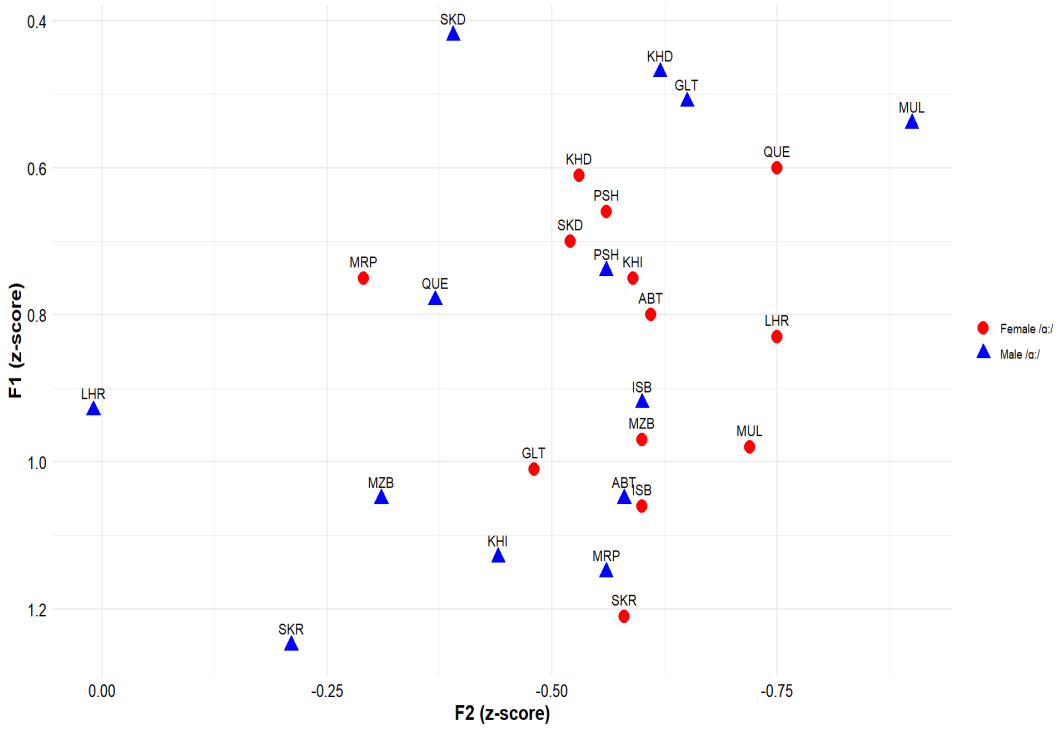

Figure 3

Z-Normalized F1–F2 Scatterplot of /a:/ Across Pakistani English Varieties (Male vs. Female)

4.3 Variability and Standard Deviation Patterns

Beyond mean values, variability measures offer insight into the stability of vowel production across regions and genders. The mean and standard deviation (z-scores) of F1, F2 in dialects are presented in Table 3.

Table 2

Mean and Standard Deviation (Z-Scores) of F1 and F2 for /a:/ Across Pakistani English Varieties

Measure	ABT	GLT	ISB	KHD	KHI	LHR	MRP	MUL	MZB	PSH	QUE	SKD	SKR
F1 Mean (F)	0.80	1.01	1.06	0.61	0.75	0.83	0.75	0.98	0.97	0.66	0.60	0.70	1.21
F1 SD (F)	0.52	0.49	0.64	0.90	0.54	0.64	0.66	0.62	0.32	0.54	0.73	0.73	0.51
F2 Mean (F)	-0.61	-0.48	-0.60	-0.53	-0.59	-0.75	-0.29	-0.72	-0.59	-0.56	-0.75	-0.52	-0.58
F2 SD (F)	0.26	0.34	0.30	0.64	0.27	0.25	0.66	0.32	0.21	0.21	0.31	0.62	0.28
F1	1.05	0.51	0.9	0.47	1.13	0.93	1.15	0.54	1.05	0.74	0.78	0.42	1.25

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Mean (M)				2										
F1 (M)	SD	0.46	0.55	0.99	0.83	0.55	0.76	0.42	0.54	0.67	0.73	0.72	0.74	0.47
F2 Mean (M)		-0.58	-0.65	-0.60	-0.62	-0.44	0.00	-0.56	-0.90	-0.31	-0.56	-0.37	-0.38	-0.20
F2 (M)	SD	0.88	0.57	0.73	0.87	1.17	1.16	0.81	0.24	0.94	0.87	1.19	0.91	0.93

As Table 2 displays, female speakers display reduced standard deviations especially F2 signifying more stable vowels articulations. The male speakers show more widely dispersed particularly in cities like Lahore (LHR) and Karachi (KHI), presenting evidence of phonetic change and social linguistic differentiation. These trends are graphically presented into Figure 3**.**

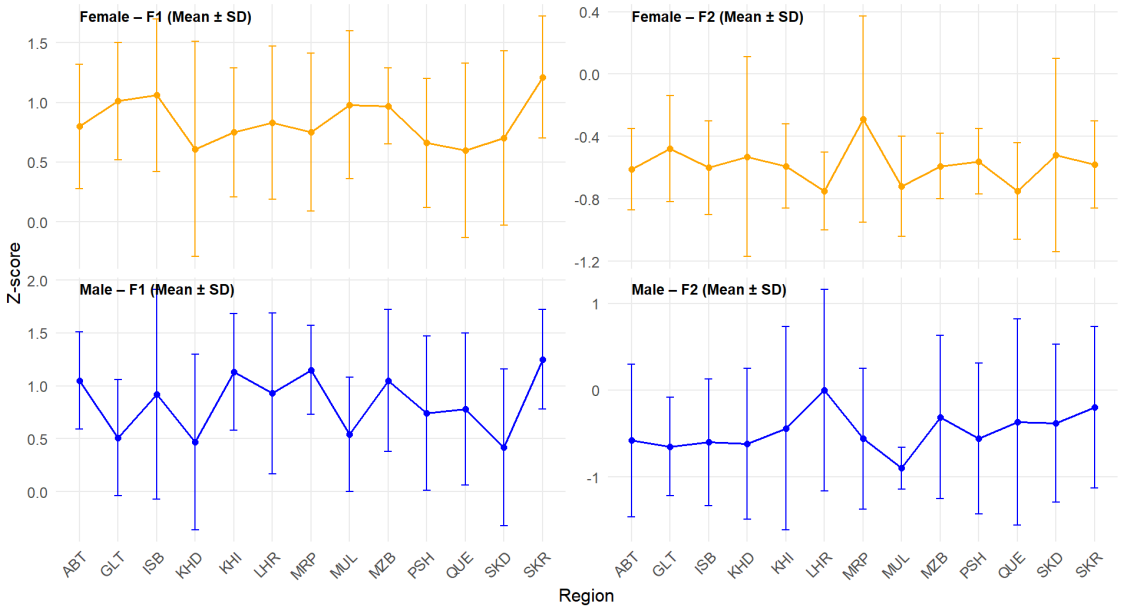

Figure 4
Mean and Standard Deviation (Z-Scores) of /a:/ Across Pakistani English Varieties

4.4 Duration Patterns of /a:/

Vowel duration displays regionally systematic variation. The longest productions of /a:/ occur in Multan (MUL), Skardu (SKD), Islamabad (ISB), and Khuzdar (KHD), while Lahore (LHR) and Peshawar (PSH) show the reduced durations. Raw mean duration values (seconds) by region and gender are presented in Table 4.

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Table 3
Mean Duration (Seconds) of /a:/ Across Regions and Gender

Measure / Region	ABT	GLT	ISB	KHD	KHI	LHR	MRP	MUL	MZB	PSH	QUE	SKD	SKR
Female Duration mean	0.21	0.23	0.23	0.23	0.19	0.18	0.21	0.23	0.21	0.17	0.20	0.23	0.21
Male Duration mean	0.24	0.20	0.21	0.22	0.20	0.20	0.22	0.22	0.19	0.21	0.21	0.20	0.22

The **Figure 4** displays mean duration differences across regions.

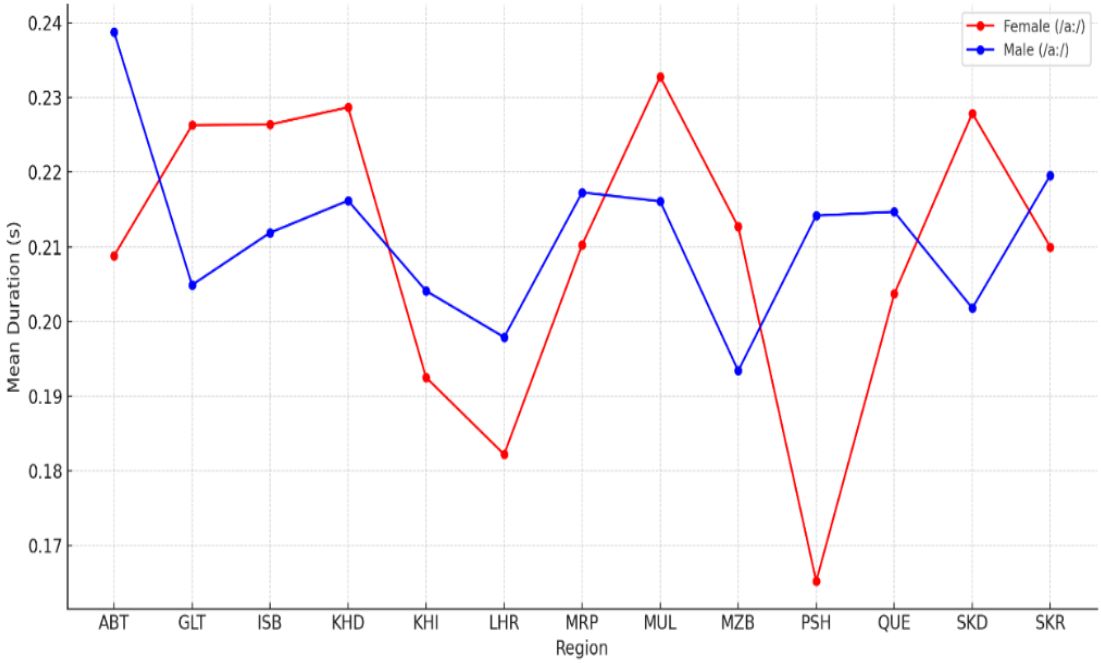

Figure 5
Mean Duration of /a:/ Across Pakistani English Regions (Male vs. Female)

4.5 Z-Score Duration Analysis

Normalized duration values are also used to explain regional differences. Table 5 shows the z-score mean durations among the two genders.

The stronger extremes of vowel lengthening are observed among male speakers, especially in Multan (MUL) and Abbottabad (ABT), whereas the duration is more moderate and stable among the female speakers. These normalized patterns of duration are represented graphically in figure 5.

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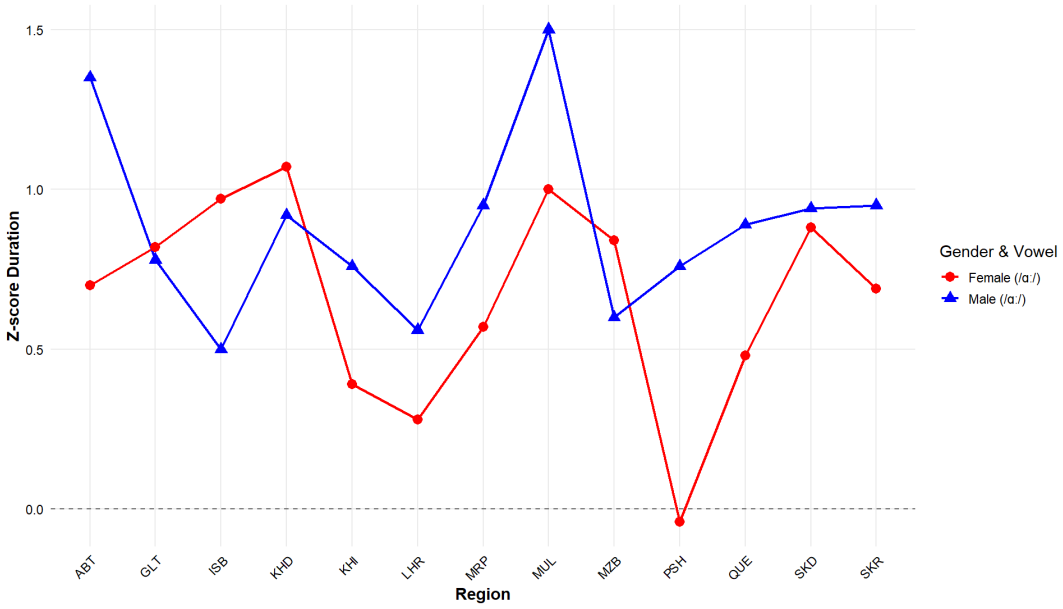

Figure 6
Z-Score Mean Duration of /aː/ Across Regions (Male vs. Female)

4.6 Distributional Patterns

To analyze distribution, **Table 6** offers mean and standard deviation z-score values for duration.

Table 4
Durational Z-Score Mean and Standard Deviation of /aː/ Across Regions and Genders

Measure	ABT	GLT	ISB	KHD	KHI	LHR	MRP	MUL	MZB	PSH	QUE	SKD	SKR
Mean (F)	0.71	0.83	0.98	1.08	0.40	0.28	0.58	1.01	0.85	-0.03	0.49	0.88	0.70
SD (F)	0.87	1.07	1.10	0.88	0.83	0.60	0.87	0.58	0.77	0.77	1.01	0.96	0.66
Mean (M)	1.36	0.78	0.64	0.92	0.77	0.57	0.96	1.51	0.60	0.76	0.90	0.94	0.95
SD (M)	0.54	0.73	0.75	0.81	1.07	1.10	0.63	0.95	0.62	0.71	0.93	1.01	1.08

In **Figure 6,** the distributional spread of durational values is exemplified by boxplots.

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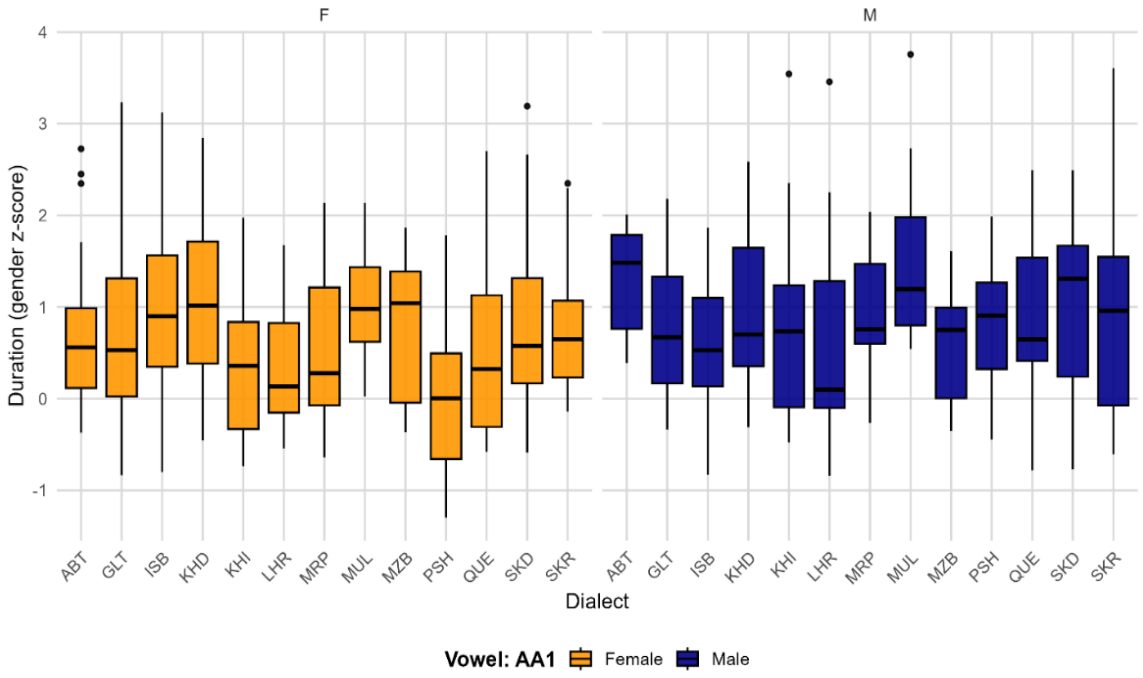

Figure 7
Boxplots of Duration Z-Scores for /a:/ Across Regions and Gender

4.7 Linguistic and Sociolinguistic Interpretation of /a:/ in Pakistani English

The production of /a:/ in the Pakistani English does not just indicate universal phonetic tendencies but also localized sociophonetic constraints. Female speakers consistently make open productions whereas males speakers demonstrate more variability in backness and duration, all comply with cross-linguistic gender tendencies in the production of vowels. The urban varieties also vary regionally, being more open and fronted, whereas peripheral varieties and northern varieties still have more backed and even conservative productions owing to substratal influence.

These regional patterns are conditioned by the influence of local languages: Sindhi-influenced regions prefer fronting, Saraiki-speaking areas exhibit backing and lengthening, whereas the Northern varieties do not favor fronting. Duration is also a social category, as male speakers draw vowel length to denote regional identification, whereas female speakers preserve temporal trends.

Altogether, the case of /a:/ as a sociophonetic marker of gender and geography in Pakistani English shows that this variety is more pluricentric than homogeneous, and the realization of this specific vowel is determined by substrate influence, gendered norms of speech, and a sociolinguistic orientation.

Table 5
Comparative Linguistic vs. Sociolinguistic Patterns of /aː/ in Pakistani English

Dimension	Linguistic / Phonetic Patterns	Sociolinguistic / Sociophonetic Patterns
F1 (Height / Openness)	Females constantly higher F1 (more open vowel); males lower F1 (less open). Cross-linguistic gender impact.	Women's openness conforms to prestige/stability; men's reduced openness denotes regional identity.
F2 (Backness / Frontness)	Females relatively centralized; males exhibit high variability. Backing is dominant pattern across regions.	Urban centers (ISB, LHR, KHI) exhibit minor fronting (prestige influence); peripheral/northern regions (QUE, GLT, SKD) retain strong backing (substratal effect). Sindhi regions (SKR, KHI) exhibit fronting, especially in women.
Duration	Males lengthen /aː/ more than females, particularly in MUL, ABT, SKR. Females retain moderate duration.	Male vowel length signals sociophonetic identity and substratal influence (Urdu, Saraiki, Pashto). Females' stable duration indicates prestige norms and reduced regional marking.
Gender Contrast	Women extend vowel space (higher F1, stable F2); men exhibit condensed but variable vowel space.	Women advance toward international norms (fronting, openness); men strengthen local/regional distinctiveness (length, backing).
Regional Patterns	Backing strongest in MUL, QUE, GLT; fronting in SKR; urban centers exhibit openness and minor fronting.	Regional substrata form productions: Sindhi → fronting, Saraiki → backing + length, Pashto/Balochi/Shina → conservative backing. Diaspora impact in MRP (fronting among females).
Overall Function	/aː/ produced as a low, back, occasionally lengthened vowel, acoustically dissimilar from British English.	/aː/ functions as a sociophonetic marker of gender and region; indicates pluricentricity of Pakistani English, substratal impact, and prestige-driven urban change.

4.8 Statistical Analysis

Two-way ANOVA tests were conducted using Region and Gender as the independent variables and F1, F2 and Duration as the dependent variables. It was also identified that there were significant main effects of Gender on F1 and duration that established that females produce more open vowels whereas males articulate longer vowels. F2 and duration had a strong influence by region, showing a high level of dialectal distinction. The significant Region x Gender interactions also indicated that gender mediates the regional difference, with male speakers contributing a lot to the regional difference.

Significant contrasts between the north, central and urban varieties were confirmed by post-hoc Tukey HSD tests especially on the F2 and duration. Backness and duration were the social salient

dimension of variation as indicated by the effect size analysis.

The two-way ANOVA findings indicate a definite regional and gender difference in the realization of /a:/ in Pakistani English. It was found that vowel height (F1) had significant main effects of region and gender, demonstrating systematic dialectal variation and a consistent difference in vowel height of men and women manifested across the varieties, which were only marginally interacted. This argues that in a relative sense, the gender influence on vowel height is consistent throughout regions.

Contrastingly, the vowel frontness (F2) was not affected by region or gender independently; however, there was a significant region-gender interaction indicating that not only fronting pattern and backing pattern could occur, but also the differences between male and female were in the regional varieties.

The duration of the vowel showed a significant regional difference which underscores the variation in duration as an important dialectal cue, whereas gender alone had no significant impact on the length of the vowel. A marginal interaction impact proposes limited, variety-specific gender disparities in length.

In general, these evidences demonstrate that /a:/ in Pakistani English is largely influenced by regional varieties, and gender has a strong impact on the height of vowels, and an interactional role in fronting patterns. This verifies /a:/ as a sociophonetic feature that has localized productions in varieties of Pakistani English.

Table 6

ANOVA Summary for /a:/ in Pakistani English

Term	df	sumsq	meansq	statistic	p.value	Measure
Dialect	12	16.909	1.409	3.80843237	1.4482E-05	F1.z
Gender	1	51.496	51.496	139.179911	1.9027E-28	F1.z
Dialect:Gender	12	7.522	0.626	1.6941221	0.06482873	F1.z
Residuals	490	181.299	0.369			F1.z
Dialect	12	4.131	0.344	0.88032879	0.5671381	F2.z
Gender	1	0.210	0.2105	0.53820214	0.46352963	F2.z
Dialect:Gender	12	8.563	0.714	1.8248475	0.04175519	F2.z
Residuals	490	191.613	0.391			F2.z
Dialect	12	0.128	0.0107	3.10575598	0.00029172	Duration
Gender	1	0.004	0.004	1.25584651	0.26298769	Duration
Dialect:Gender	12	0.065	0.005	1.58915001	0.09102194	Duration
Residuals	490	1.680	0.003			Duration

The Tukey post hoc test demonstrates a significant gender influence in the production of /a:/ where the male speakers have lower values on F1 compared to female speakers of all regions except one (where gender difference is in the opposite direction). Besides this overall gender trend, the review also shows regional variation specifically among SKD male speakers who do not share the overall male trend and patterns of vowel realization. In general, the results show that the /a:/ variation in the Pakistani English is not only determined by the gender differences that are physiologically based but also by the region specific sociophonetic variation.

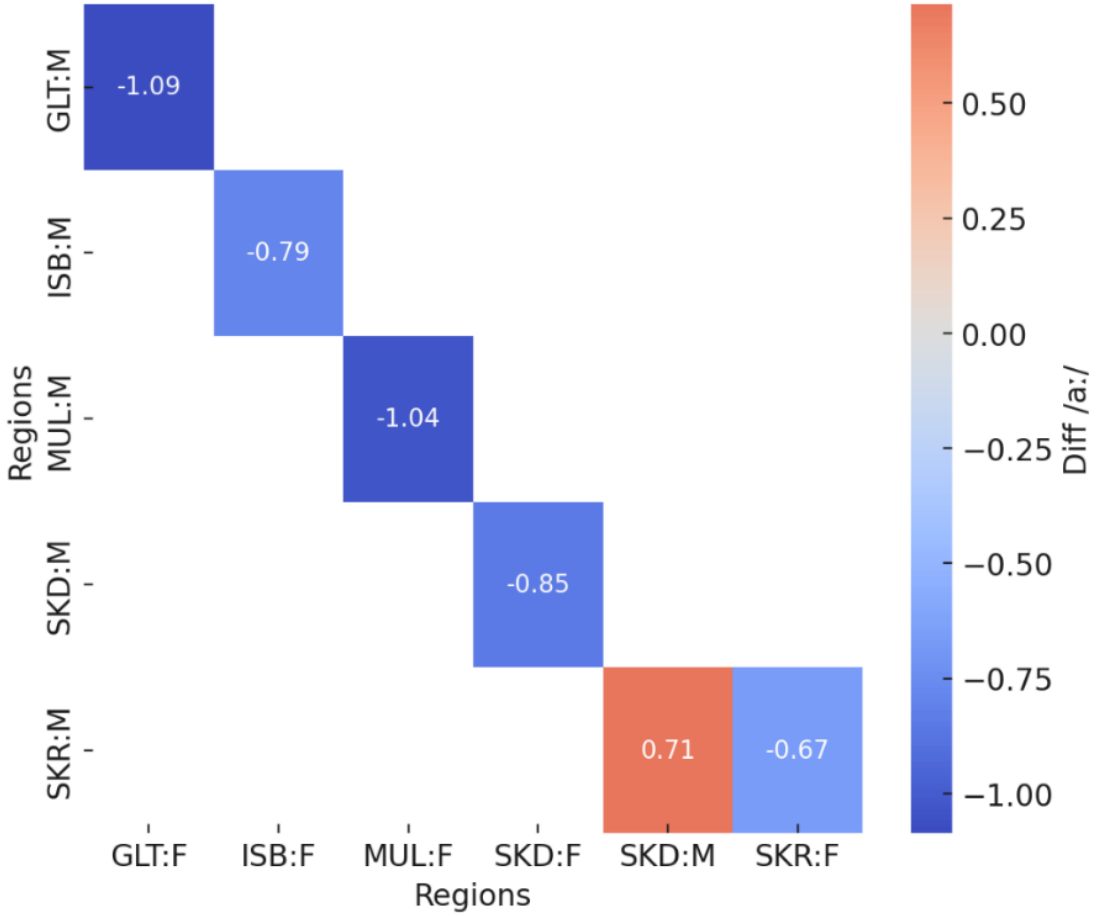

Figure 8
Significant Tukey HSD contrasts in F1 (vowel height) for /a:/ across dialects and genders in Pakistani English

This heatmap has shown just a meaningful comparison of vowel /a:/ in MUL and LHR males in which F2 composition is situated negative (-0.81). It means that MUL speakers produce sound /ɑ:/ at lower F2 than LHR speakers such that pronunciation of /a:/ in MUL is relatively more back or centralized than it is in LHR. It only reports a small range, however, demonstrates that there is a slight regional variation among the male speakers in the articulation of /ɑ:/.

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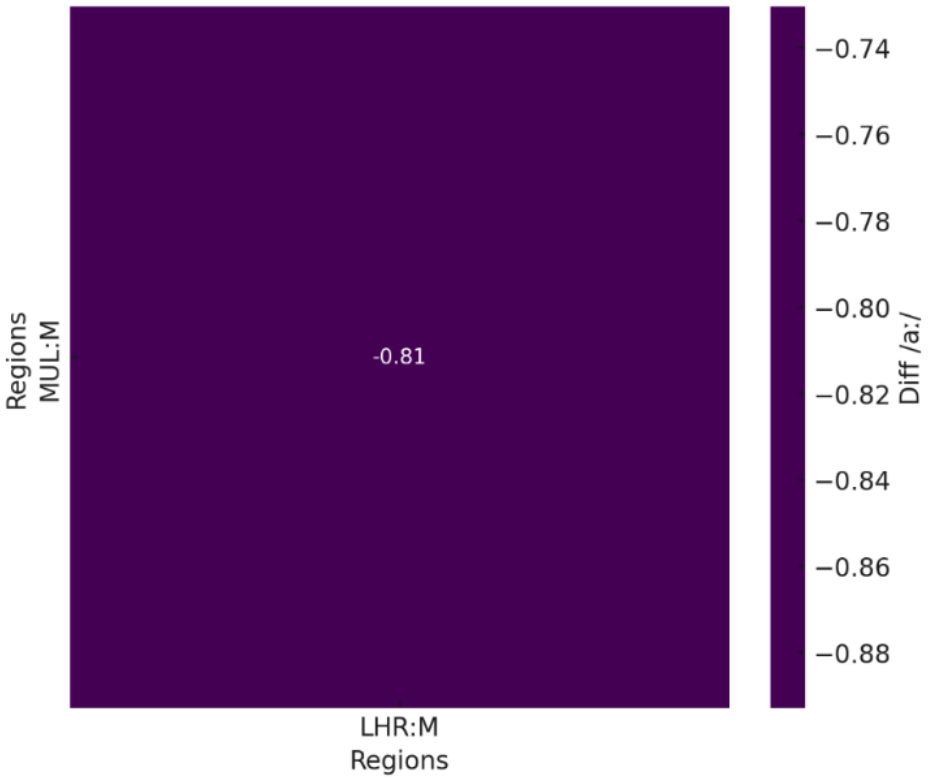

Figure 9
Significant Tukey HSD contrasts in F2 (vowel backness/frontness) for /a:/ across dialects and genders in Pakistani English

The figure below displays the durational differences of the vowel /ɑ:/ of female speakers of various regions. The duration of the vowels of PSH females (PSH:F) is continuously shorter than the duration of the vowels of the females in GLT, ISB, KHD and MUL (about -0.06 to -0.08). Instead, SKD:F females generate/ɑ:/ somewhat longer than PSH females do (+0.06). Taken together, the trend shows that the females of PSH tend to have shorter /ɑ:/ but SKD female tend to have longer ones, which demonstrates the geographical dissimilarity in the vowel production in the time domain.

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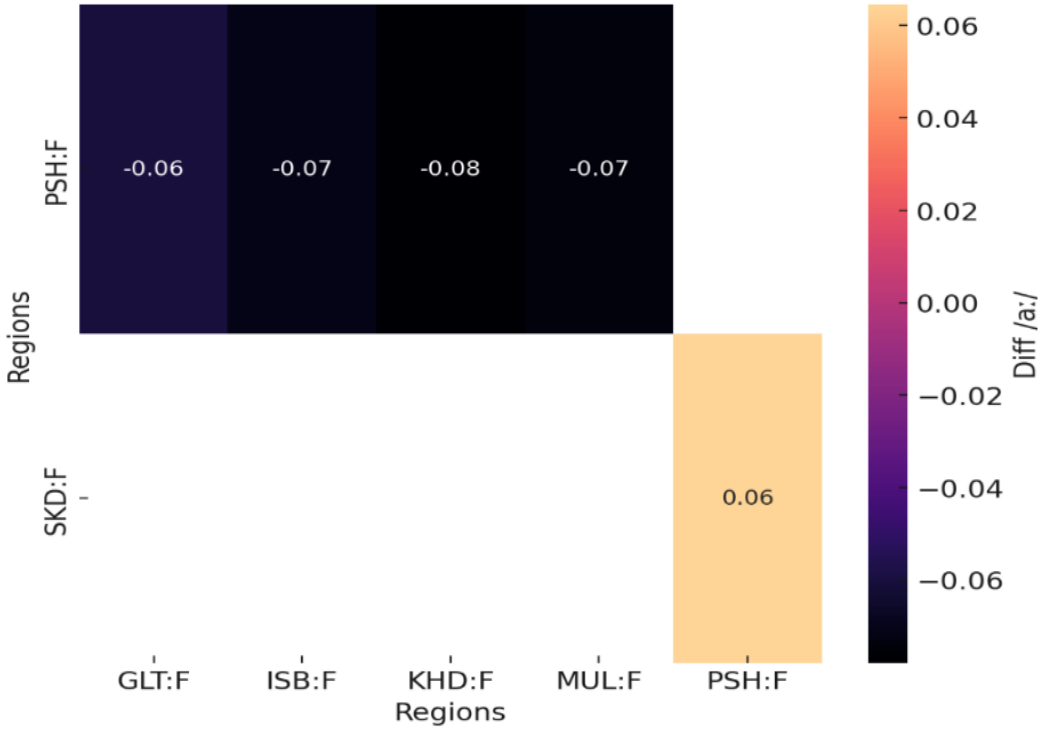

Figure 10
Significant Tukey HSD contrasts in Duration for /a:/ across dialects and genders in Pakistani English

5. Interpretation of Findings

5.1 Acoustic Realization of /a:/ in Pakistani English

The acoustic study of long low vowel /a:/ indicates orderly region and gender variation in Pakistani English. Across all thirteen varieties, female speakers constantly articulated higher F1 values than male speakers, demonstrating more open vowel productions, whereas male speakers displayed greater spreading in F2, indicating greater variation in vowel backness (Table 1; Figure 1).

These trends were verified by Z-score normalization indicating homogeneity in patterns when the physiological differences of speakers were taken into consideration. Both male and female speakers presented relatively negative F2 z-scores, which means that /a:/ is typically fulfilled as a backed vowel in all Pakistani varieties of English (Table 2; Figure 2). The most robust backing was noted in Multan (MUL), Quetta (QUE), and Gilgit (GLT), whereas urban centers like Lahore (LHR) and Islamabad (ISB) expressed relatively less backing.

There was also strong regional differentiation of vowel duration. There were longer realizations of /a:/ in Multan (MUL), Abbottabad (ABT), and Skardu (SKD), while shorter in Lahore (LHR) and Peshawar (PSH) (Table 4). Male speakers would give out higher extreme values of duration across regions versus the more moderately and uniformly distributed temporal patterns by females.

5.2 Statistical Effects of Region and Gender

Two-way ANOVAs were conducted with Region and Gender as the independent variables and F1,

F2 and duration as the dependent variables to test the statistical significance of these patterns (Table 6).

For vowel height (F1), the main effects of both Region ($p < .001$) and Gender ($p < .001$), showing the systematic regional differentiation and strong gender contrast, with females more likely to have a more open realization of /a:/. The significant difference in interaction between Gender and Region also had a marginal significance ($p \approx .065$), which indicates that the difference in vowel height between genders is relatively similar across regions.

Contrastingly, the main effects of Region and Gender did not affect vowel backness (F2); nevertheless, significant interactions between Region and Gender ($p < .05$) are evidence that fronting and backings patterns do not appear independently but rather under the action of their interplay. Such an interaction is indicative of the fact that differences in male-female variations in vowel backness are not equally represented across regional varieties.

For duration, a significant primary effect of Region ($p < .001$) proves that the vowel length as a dialectal marker is a substantially significant cue in Pakistani English. The main effect of Gender and the interaction doesn't reach significance, even though the marginal interaction ($p \approx .09$), in temporal realization, indicates limited, variety-specific gender variances.

The Tukey HSD post hoc tests found a few statistically significant contrasts. It is noteworthy that Multan male speakers articulated significantly more backed productions of /aː/ than Lahore male speakers and female speakers of Peshawar constantly articulated shorter-duration vowels than northern and central dialects (Figures 7-9).

6. Discussion

The results indicate that the production of /a:/ in Pakistani English is influenced by an interplay of universal phonetics and local sociophonetics constraints. Mostly, female speakers found more open and relatively constant realizations of /aː/ whereas male speakers more varied in the backness and duration of their vowel. These trends are in line with cross-linguistic sociophonetic studies that indicated that women usually preserve more peripheral and stable vowel targets, whereas men are more likely to index regional identity using phonetic variation (Labov, 2001; Eckert & McConnell-Ginet, 2013; Johnson, 2020).

Those regional trends also show the impact of substrate languages. Robust backing and lengthening in Multan (MUL) conform to Saraiki phonology, with low vowels normally long and retracted. On the same note, conservative backing in Quetta (QUE), Gilgit (GLT), and Skardu (SKD) matches with phonological systems of Balochi, Pashto, Shina, and Balti that do not allow the vowel fronting. Conversely, areas with the Sukkur (SKR) and Karachi (KHI), where Sindhi is spoken, have a more fronted realization of /aː/ especially in the speech of female speakers, an effect of the progression of vowels in Sindhi.

The partial overlap into less backed and more open productions is demonstrated in urban centers like Lahore (LHR), Islamabad (ISB) and Karachi (KHI), in line with being exposed to supralocal and global English norms. The fact that female speakers are expected to dominate these patterns provides social linguistic explanations that place women as pioneers in prestige-based change, leaving regionally marked variations as more variable backness and duration to male speakers.

The patterns of duration also add to the sociophonetic interpretation of /a:/. The greater vowel lengthening of male speakers, especially in Multan (MUL) and Abbottabad (ABT), is attributable to both the substrate effect of the Urdu language and regional languages influence as well as phonemic

length distinction and use of the time as a marker of local identity. The more stabilized norms of Pakistani English by female speakers indicate their moderates' trends of duration.

A combination of these data points confirms that /a:/ is a sociophonetic marker of gender and region of Pakistani English. Phonologically, the vowel is produced as low, backed, and usually extended, which is not consistent with British English standards but rather it is consistent with Urdu and regional phonology. Sociolinguistically, /a:/ differentiation indicates the multi-centricity of Pakistani English that has been influenced by the contact-based change, gendered speech conventions, and the sense of the regional identity.

7. Conclusion

This paper presents an empirical acoustic description of the vowel /a:/ in Pakistani English revealing systematic gender-specific and regional disparity in vowel height, backness, and duration. The female speakers ground the vowel through opening and stability, whereas, the male speakers can count on the backness and length to mark regionality. The results validate the perception of Pakistani English as a pluricentric one with internally organized phonic variation and add to the overall socio-phonetic research on World Englishes.

Note: The data were collected independently by the PhD scholar, Ms. Mumtaz Yaqub, without any external funding support. Later, the scholar was awarded an IRSIP scholarship, which enabled her to visit the University of Arizona, USA, for data analysis. The analysis was conducted at the Douglas Phonetics Laboratory under the supervision of Dr. Natasha Warner.

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