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MERGER OF HIGH VOWELS IN PAKISTANI ENGLISH: AN ACOUSTIC INVESTIGATION

Dr. Ijaz Asghar[1] , Dr. Shahid Abbas[2] , Hafiz Ahmad Bilal[3], Junaid Anwar[4]

[12,3] Department of English, University of Sargodha, Pakistan.

[4] Department of English, Readers College Sargodha, Pakistan.

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Abstract:

Non-native varieties of Englishes in outer and expanding circles show a tendency to merge long and short vowels, particularly /i/ & /i:/ and /u/ & /u:/. The current study aims at finding the phenomenon whether Pakistani speakers of English merge long and short vowels or whether they articulate them as distinct vowel phonemes. Fifty participants(twenty five male and twenty five female) from among the students of MPhil English University of Sargodha, all with Urdu as their mother tongue, were scrutinized and selected for the research purpose,observing a meticulous process of selection. Monosyllabic words with /hVd/ context, containing the required vowel tokens were selected and recorded using a carrier phrase. The participants were recorded individually in a noise free atmosphere. Praat was used for the acoustic measurement of formant frequencies F1 and F2, and of duration of the vowel tokens.Tukey's HSD test for statistical analysis was performed to see whether the results are significant. The results showed that Pakistani English speakers did not merge long and short vowels, i.e. /i/ & /i:/ and /u/ & /u:/, rather they realized them as distinct vowel phonemes.

Introduction:

Englishes in Asia, belong to the outer and expanding circle varieties of non-native Englishes. Owing to diversity of local languages in the continent, there are several emergent varieties of English with their distinct and unique linguistic features, i.e. phonological, lexical, grammatical, semantic, discourse, stylistic, etc. Each emerging variety of non-native Englishes is passing

through almost a similar process of indigenization and acculturation. The new features of these varieties are reported to be different as well as similar at various linguistic levels.

Looking at the level of pronunciation, it is observed that due to their being syllable-timed languages (Crystal, 2003; Mesthrie and Bhatt, 2008), and difference in the number of phonemes and in their realization,each variety of outer and expanding circle Englishes, has particular set of phonological features (Mesthrie, 2004; Deterding, 2010;Deterding& Kirkpatrick, 2006; Gut, 2004; Schmied,2004). These varieties have differences in their phonemic inventories too, eg.Asian Englishes have changed the fricatives /Ɵ/ and /Ꝺ/ into dental plosives (Mesthrie, 2004; Deterding, 2010; Deterding& Kirkpatrick, 2006).

Literature Review:

It has been reported that Asian Englishes do not distinguish among longand short vowels, eg. Malaysian English(Zuraidah, 2000 as cited in Bautista & Gonzalez, 2006),Philippine English (Gonzalez &Alberca, 1978), Singapore English (Deterding, 2007; Wee, 2004), Indian English (Kachru, 2005), Hong Kong English (Hung, 2012), Brunei English (NurRaihan and Deterding, 2016), and Japanese English (Date, 2006). Certain varieties do not distinguish between /f/ and /v/ or change them into /b/ and /p/, eg. Hong Kong English (Hung, 2012), Philippine English (Tayao, 2008). Various other phonological features of the outer-circle varieties of Englishes have also been reported by researchers.

Considering the study under discussion, it is observed that Pakistani English is an emerging variety of English. Pakistani English is a less-explored variety, though a few researchers have ventured in exploring the phonological features of the variety.Rehman (1990) has classified Pakistani English into four different categories. It is reported thatPakistani English is a syllable-timed and rhotic variety of English (Mahboob&Ahmar, 2004; Mesthrie& Bhatt, 2008; Hickey, 2005). Vowel phonemes of Pakistani English have been studied by various researchers (Mahmood & Farooq, 2017, 2018; Bilal, et al 2011a, 2011b, 2011c, 2011d, 2021a, 2021b;Abbasi, et al 2018a, 2018b, Sheikh 2012; Hassan &Imtiaz, 2015).

Research Objective:

The current study is an acoustic investigation into the properties of high vowel phonemes of Pakistani English with the aim to find out if there is any merger of long and short high front and high back vowels or they are realized as distinct phonemes.

Research Questions:

The research is focused to explore the following dimensions of Pakistani English:

1. Do speakers of Pakistani English merge high front vowels, i.e. /i/ & /i:/?
2. Do speakers of Pakistani Englishmerge high back vowels, i.e. /u/ & /u:/?

Materials And Method:

The study is an acoustic investigation into the high vowels of Pakistani English. The step by step procedure of the study is mapped below.

Participants:

For the study, students enrolled in MPhil English at University of Sargodha were selected after a rigorous process of selection. The participants were pre-interviewed to determine the following variables:

1. Age group (participants should be between 20-25 years of age)
2. Exposure to English (participants should have English as their medium of instruction since their pre-schooling)
3. Fluency (participants should be fluent to speak English in various everyday situations)
4. Ethnic background (participants should have Urdu as their mother tongue)

Word-List:

Minimal pairs of monosyllabic words containing the required vowel tokens (i.e. /i/, /i:/, /u/ and /u:/) with /hVd/ context were selected. Following is the list of pairs of words selected for the analysis:

hid &heed	/hid/ & /hi:d/
hood & who'd	/hud/ &hu:d/

The advantage of using /hVd/ context (null context) is that it has little effect on the vowel quality (Steven & House, 1963, as cited in Roeder, 2009). Vowel formants are affected by the onset segment, which is neutralized by /h/ phoneme (Hillenbrand, Clark, &Nearey, 2001). According to Wells (1962), 'The frame /h-d/ is particularly suitable for studies of English vowels, since (i) /h/ has so little influence on following vowels, and (ii) it so happens that a real English word results for nearly every 'pure' vowel in this sequence.' (para 54)

Recordings:

The words were recorded using a carrier phrase 'would you please say _____ loudly'. For recording, hi-tech equipment was used. The recordings were made in a noise free environment of sound proof compartment of University Radio Station.

Procedure:

Each participant was asked to speak the words using the carrier phrase to give the analysis an outlook and feel of connected speech. There was a pause between two articulations. Total tokens elicited for the analysis amounted to two hundred i.e. fifty tokens for each vowel, with further distribution of twenty five male and twenty five female vowel tokens. Each token containing the required vowel was detached from its context and was extracted using Praat. Formant frequencies of first two formants F1-F2 were measured, using default settings for Praat analysis i.e. 5000Hz for male participants and 5500Hz for female participants, as female speakers have higher frequencies. Averages of the two formants were calculated and plotted in the vowel trapezium. Duration of each token was also measured and recorded as, for the vowels under discussion, the major variable to be studied and observed was the duration of articulation. To ascertain if the difference among the formants and durational properties of the vowels was significant, Tukey's HSD Test was performed.

Analysis:

Formant frequencies of female speakers are higher as compared to male speakers due to differences in the sizes of the oral cavities and trachea. Hence, separate analysis for male and female speakers was necessary to draw relatively precise and accurate conclusions.

Analysis of Vowels as Articulated by Male Participants:

The results of the analysis of the vowels articulated by male speakers are given below.

Pattern of Articulation in /i/

The Praat analysis showed that the vowel was articulated as short high front vowel. The minimum value of the first formant was 330Hz and the maximum was 480Hz. For the second formant F2, the values of the formants remained 2375Hz and 2930Hz minimum and maximum respectively. The mean values recorded for F1 and F2 were 395Hz and 2740Hz respectively. Tukey's HSD Test showed insignificant difference among the formant properties of the speakers, which means that all the participants realized the vowel /i/ in a similar pattern. While the difference between F1 and F2 remained significant (at $P<0.05$). The average duration of articulation of /i/ remained 0.36 seconds.

Pattern of Articulation in /i:/

The vowel was articulated as high front vowel by the male speakers. The duration of articulation of the vowel showed that it was pronounced as a long vowel. The formant frequencies of F1 and F2 fluctuated between 320Hz and 440Hz and 2530Hz and 3200Hz respectively. The mean values of F1 and F2 were 350Hz and 2970Hz respectively.The average duration of articulation was 0.58 seconds. Statistical analysis showed that all the participantsarticulatedthe vowel /i:/ in a similar manner. The difference between the average values of F1 and F2 remained significant at $P<0.05$.

Comparison of /i/ and /i:/

The analysis ascertained that both the vowels were articulated as two distinct phonemes. Both were pronounced as high front vowels. Tukey's HSD Test showed that the difference among the formant frequencies of the two vowels remained significant. The duration of the articulation of the two phonemes showed significant variation. To conclude, it is observed that /i/ was articulated as short high front vowel while /i:/ was articulated as long high front vowel. The two vowel phonemes are placed in the trapezium according to their formant frequencies (Fig1).

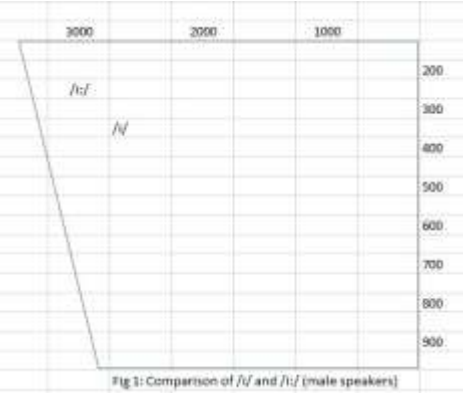

Fig 1: Comparison of /i/ and /i:/ (male speakers)

Tukey's HSD Test (Fig 2) showed the significant variation among the formant frequencies of F1 and F2 of the two vowels.

Tukey's HSD Test: Comparison of F1 and F2 of /i/ and /i:/ of male speakers

	Treatments					
	1	2	3	4	5	Total
N	25	25	25	25		100
ΣX	1975	13700	1750	14850		32275
Mean	395	2740	350	2970		1613.75
ΣX^2	780135	37538010	612510	44104510		83035165
Std.Dev.	1.5811	1.5811	1.5811	1.5811		1279.3506

Result Details

Source	SS	df	MS	
Between-treatments	30951343.75	3	10317114.5833	F = 4126845.83333
Within-treatments	40	16	2.5	
Total	30951383.75	19		

The f-ratio value is 4126845.83333. The p-value is < .00001. The result is significant at p < .05.

Fig 2

The comparison of the durational properties of the two phonemes is given below (Fig 3) which clearly indicates the difference of duration of articulation of the two phonemes. .

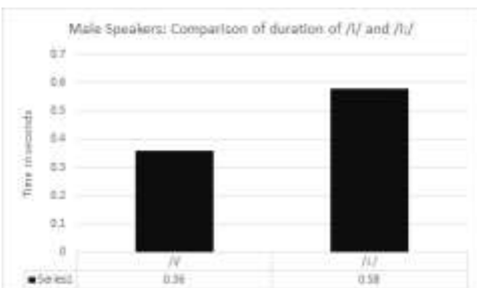

Fig 3

Pattern of Articulation in /u/

Male speakers pronounced it as high back vowel. The average duration of articulationof the vowel (i.e. 0.35 seconds) showed that it was realized as a short vowel. The formant frequencies of F1 wavered between 380Hz (minimum) and 460Hz (maximum), and of F2, 990Hz (minimum) and 1120Hz (maximum). The mean values of formants of F1 and F2 remained 410Hz and 1070Hz respectively. Tukey's HSD Test showed that all the participants articulated the vowel in a similar manner. The difference between the values of formants of F1 and F2 remained significant at $P<0.05$.

Pattern of Articulation in /u:/

The vowel was pronounced at long high back vowel, as the average duration of articulation of the vowel remained 0.67 seconds. The formant frequencies wavered between 320Hz-410Hz for F1 and 950Hz-1070Hz for F2. The mean values of formants of F1 and F2 remained 360Hz and 1030Hz respectively. Statistical analysis showed that there is no significant difference in the pattern of articulation of all the participants, i.e. the vowel was pronounced in a similar manner by all the participants. The difference among the formant values of F1 and F2 was significant at $P<0.05$.

Comparison of /u/ and /u:/

The acoustic measurement of the formant frequencies and the durational properties showed that male speakers distinguished between the two vowels. /u/ was pronounced as short while /u:/ as long. The figure below (Fig 4) shows the placement of both the vowels in a trapezium.

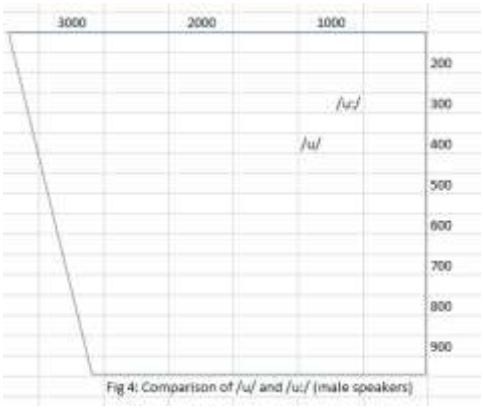

Fig 4: Comparison of /u/ and /u:/ (male speakers)

Tukey's HSD test showed significant variation (at $P<0.05$) among the formant frequencies (F1 and F2) of the two vowels which means that the speakers clearly differentiated between the two vowels (Fig 5).

Tukey's HSD Test: Comparison of F1 and F2 of /u/ and /u:/ of Male Speakers

	Treatments					
	1	2	3	4	5	Total
N	20	20	20	20		100
ΣX	3050	5350	1900	5150		14350
Mean	410	1070	380	1030		717.5
ΣX²	940510	5724510	940010	5304510		12317540
Std Dev	1.5811	1.5811	1.5811	1.5811		341.8307

Result Details

Source	SS	df	MS	
Between-treatments	2221375	3	740458.3333	F = 296183.33333
Within-treatments	40	16	2.5	
Total	2221415	19		

The F ratio value is 296183.33333. The p value is < .00001. The result is significant at p < .05.

Fig 5

The difference of the length of articulation of the two vowel phonemes is presented in the following graph (Fig 6) exhibiting that /u/ is articulated as short and /u:/ is articulated as long vowel by male speakers.

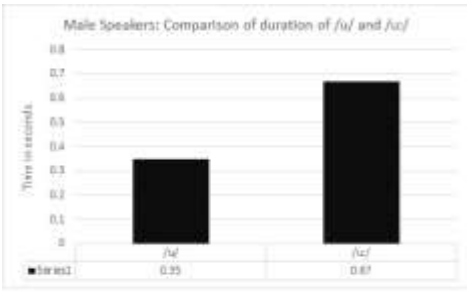

Fig 6

Analysis of Vowels as Articulated by Female Participants:

Female speakers have higher frequencies as compared to male speakers. The analysis of the vowels of female speakers is given below.

Pattern of Articulation in /i/

Female speakers pronounced /i/ as high front vowel like their male counter-parts. The durational properties of the articulation showed that it was articulated as a short vowel. The average duration remained 0.41 seconds.The mean formants of F1 and F2 remained 450Hz and 2950Hz respectively. The minimum and maximum values of F1were 400Hz and 510Hz and of F2, 2470Hz and 3040Hz. Tukey's HSD Test establishedthat the difference between the values of F1 and F2 remained significant. The vowel was pronounced in a similar pattern by all the speakers.

Pattern of Articulation in /i:/

Female speakers pronounced /i:/ as high front vowel. The durational properties showed that it was pronounced as a long vowel. Statistical analysis showed that all the participants pronounced it in a similar pattern. The formantsof F1 and F2 varied between 360Hz and 470Hz and 2640Hz and 3260Hz respectively. The mean values of F1 and F2 were 390Hz and 3140Hz respectively. The average duration of articulation was 0.68 seconds. The variation between the average formant frequencies of F1 and F2 remained significant at $P<0.05$.

Comparison of /i/ and /i:/

The analysis established that both the vowels were pronounced as two discrete phonemes. Both were pronounced as high front vowels. The duration of the articulation of the two phonemes showed significant variation. To sum up, it is examined that /i/ was articulated as short high front vowel while /i:/ was articulated as long high front vowel. The two vowel phonemes are placed in the trapezium according to their formant frequencies (Fig7).

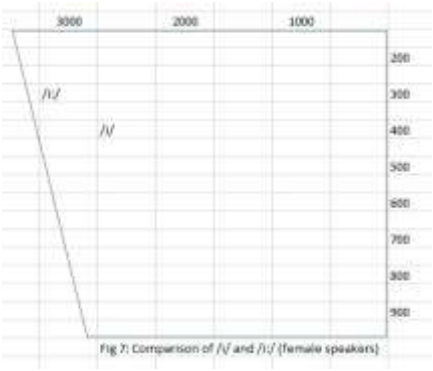

Fig 7: Comparison of /i/ and /i:/ (female speakers)

Tukey's HSD Test indicated that the difference among the formant frequencies of the two vowels remained significant, which means that the two vowels are distinct phonemes(Fig 8).

Tukey's HSD Test: Comparison of F1 and F2 of /i/ and /i:/ of female speakers

	Treatments					
	1	2	3	4	5	Total
N	25	25	25	25		100
ΣX	2250	14750	1950	15700		34650
Mean	450	2950	390	3140		1732.5
ΣX^2	1012510	43512510	760510	49298010		94583540
Std.Dev.	1.5811	1.5811	1.5811	1.5811		1348.5356

Result Details

Source	SS	df	MS	
Between-treatments	34652870	3	11517488.3333	F = 4609993.33333
Within-treatments	40	16	2.5	
Total	34692410	19		

The F-ratio value is 4609993.33333. The p-value is < .00001. The result is significant at p < .05.

Fig 8

The figure below (Fig 9) represents the difference of duration of articulation of /i/ and /i:/ as realized by Pakistani female speakers of English.

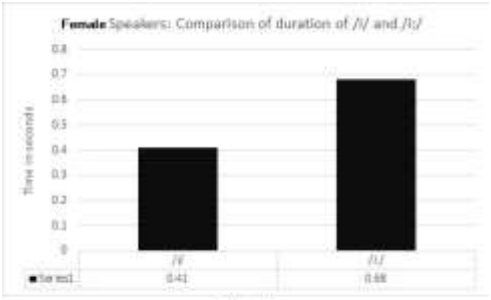

Fig 9

Pattern of Articulation in /u/

Female speakers articulated /u/ as high back vowel. The length of articulation of the vowel (i.e. 0.38 seconds) indicated that it was realized as a short vowel. The formant valuesof F1 vacillated between 410Hz and 490Hz minimum and maximum respectively, and of F2, 1030Hz and 1200Hz minimum and maximum respectively.The average values of formant frequencies of F1 and F2 remained 440Hz and 1130Hz. Tukey's HSD Test demonstrated that all female participants articulated the vowel in a similar manner. The variation between the formant values of F1 and F2 remained significant at $P<0.05$.

Pattern of Articulation in /u:/

The vowel /u:/ was pronounced as long high back vowel, as the average length of articulation of the vowel remained 0.65 seconds. The formant frequencies oscillated between 340Hz-430Hz for F1 and 890Hz-970Hz for F2. The averages of F1 and F2 remained 370Hz and 930Hz respectively. Tukey's statistical analysis indicated that there was no significant difference in the pattern of articulation of all the participants, i.e. the vowel was articulated in a similar manner by

all the participants. The difference among the formant frequencies of F1 and F2 was significant at P<0.05.

Comparison of /u/ and /u:/

The acoustic analysis of the formant frequencies of the vowels /u/ and /u:/ and their durational properties confirmed that female speakers differentiated between the two vowels. /u/ was pronounced as short while /u:/ as long. The figure below (Fig 10) displays the placement of both the vowels i.e. /u/ and /u:/ in a trapezium.

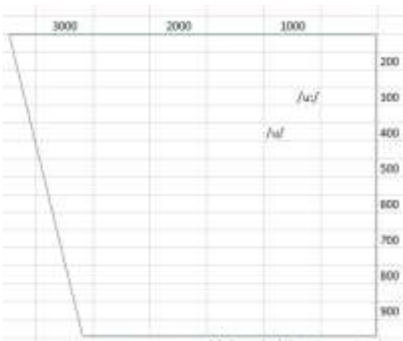

Fig 10: Comparison of /u/ and /u:/ (female speakers)

Tukey's HSD statistical analysis verified significant variation (at P<0.05) among the formant frequencies of F1 and F2 of the two vowels which means that the female speakers differentiated the two vowels as two distinct phonemes (Fig 11).

Tukey's HSD Test: Comparison of F1 and F2 of /u/ and /u:/ of female speakers

	Treatments					
	1	2	3	4	5	Total
N	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
ΣX	2200	[illegible]	[illegible]	[illegible]		[illegible]
Mean	440	1130	[illegible]	[illegible]		717.5
ΣX²	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
Std.Dev.	1.5811	1.5811	1.5811	1.5811		[illegible]

Result Details

Source	SS	df	MS	
Between-treatments	[illegible]	3	[illegible]	F = [illegible]
Within-treatments	40	16	2.5	
Total	[illegible]	19		

The F-ratio value is [illegible]. The p-value is < .00001. The result is significant at p < .05.

Fig 11

The variation in duration of articulation of the two vowels,i.e. /u/ and /u:/ is presented in the following graph (Fig 12) exhibiting that /u/ is articulated as short and /u:/ as long vowel by female speakers.

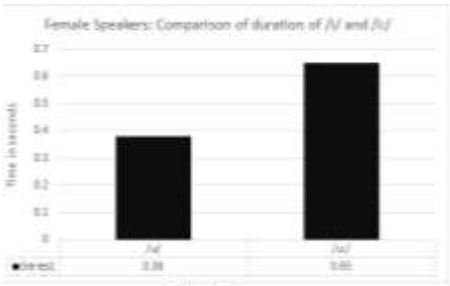

Fig 12

Comparison of Male and Female Articulation:

The pattern of pronunciation of the four high vowels i.e. /i/, /i:/, /u/and /u:/, among male and female speakers of Pakistani English remained similar. All the participants, without any exception, articulated them following the pronunciation pattern of native Englishes. The participants realized /i/ and /i:/ as high front vowels, where /i/ was articulated as short and /i:/ as long vowel. The vowels /u/ and /u:/ were articulated as high back vowels where /u/ was articulated as short and /u:/ as long vowel.The only difference that can be observed between the articulation of male and female speakers was the duration of articulation of high front vowels. Female speakers took relatively more time in pronouncing the high front vowels, i.e. /i/ and /i:/, while the duration of high back vowels, i.e. /u/ and /u:/, remained almost alike.The comparison of the duration of articulation of male and female speakers is given vbelow (Fig 13).

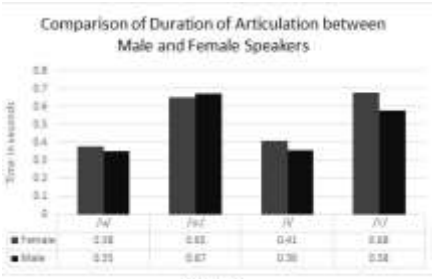

Fig 13

Conclusion:

The study was conducted to see whether Pakistani English follows other non-native varieties of English with respect to the merger of long and short vowels. On the basis of the above analysis and discussion, it can be concluded that Pakistani English does not merge long and short vowels rather it clearly discriminates between long and short vowels as distinct phonemes. In this particular aspect, it stands unique among other outer and expanding circle varieties, where the merger of short and long vowels occur as reported by many researchers mentioned in the introduction. It can further be concluded that by distinguishing the long and short vowels, Pakistani English show the tendency to follow native varieties of Englishes, i.e. British English, North American English, where one of thecriteria ofclassification of vowels is their duration.

Implications:

The current study is an attempt to investigate the properties and characteristics of Pakistani English to strengthen the idea that Pakistani English is an emerging variety of Asian Englishes, which needs to be documented and codified. It is believed that this attempt will entice the academicians and researchers to turn their heads to this particular variety of English. The current

research focusses on the merger of long and short vowels only, but the future researchers can opt to explore many other dimensions of this particular variety, including but not limited to the study of diphthongs, triphthongs, consonants, stress and intonation patterns, phonotactics, etc.

It is also worth-mentioning that the current study presents a limited data with only fifty participants. Similar studies are the need of the hour to examine a large data. Further, the participants chosen for the study belonged to juvenile age group with Urdu as their mother tongue. Future researchers can change the variables including age group, ethnic background of the participants etc, to collect and represent a heterogeneous and natural data.

References:

Abbasi et al. (2018a). Acoustic Characteristics of Pakistani English Vowel Sounds. Doi: 10.5539/ijel.v8n5p27

Abbasi et al. (2018b). An Acoustic Investigation of Pakistani and American English Vowels. International Journal of English Linguistics, (8)4

Bautista, M., & Gonzalez, A. (2006). Southeast Asian Englishes. In Kachru, B. Kachru, Y., & Nelson, C. (Eds.), A handbook of world Englishes (pp. 130-144). Oxford: Blackwell Publishing Company.

Bautista, M., & Gonzalez, A. (2006). Southeast Asian Englishes. In B. Kachru, Y. Kachru& C. Nelson (Eds.), A handbook of world Englishes (pp. 130-144). Oxford: Blackwell Publishing Company.

Bilal, H. A. et al (2011a). Acoustic Analysis of Central Vowels of Pakistani English. International Journal of Linguistics, (3)1

Bilal, H. A., Mahmood, M. A. &Saleem, R. M. (2011b). Acoustic analysis of front vowels of Pakistani English. International Journal of Academic Research, 3 (6-I), 20-27.

Bilal, H. A., Mahmood, M. A. &Saleem, R. M. (2011c). Merger of /i:/ and /I/ in Pakistani English. International Journal of Linguistics, 3 (1), E34. doi:10.5296/ijl.v3i1.1041.

Bilal, H. A., Mahmood, M. A. &Saleem, R. M. (2011d). Merger of /e/ and /æ/ in Punjabi English. International Journal of Academic Research, 3 (6-II), 407-412.

Bilal. H. A, et al. (2021a). Acoustic Investigation of Back Vowels of Pakistani English. Review of Education, Administration & Law, 4(1), 37-52.

Bilal. H. A, et al. (2021b). Diphthongs of Pakistani English. Elementary Education Online, 20(5), 4920-4931.

Crystal, D. (2003). English as a Global Language (2nd ed.). Cambridge: Cambridge University Press.

Date, T. (2006). The intelligibility of Singapore English from a Japanese perspective. In D. Deterding, A. Brown, & E. L. Low (Eds.), English in Singapore: Phonetic research on a corpus (pp. 173–183). Singapore: McGraw-Hill.

Deterding, D. (2007). Singapore English (Dialects of English). Edinburgh: Edinburgh University Press.

Deterding, D. (2010). Variation across Englishes: Phonology. In A. Kirkpatrick (Ed.), The Routledge handbook of world Englishes (pp. 385–399). Abingdon: Routledge.

Deterding, D., & Kirkpatrick, A. (2006). Emerging South-East Asian Englishes and intelligibility. World Englishes, 25, 391– 409.

Gonzalez, A.,&Alberca, W. (1978). Phillipines English of the Mass Media. Menilla: De La Salle University Research Council.

Gut, U. (2004). Nigerian English: Phonology. In E. W. Schneider, K. Burridge, B. Kortmann, R. Mesthrie, & C. Upton (Eds.), A handbook of varieties of English, Volume 1: Phonology (pp. 813– 830). Berlin: Mouton de Gruyter.

Hassan, S. &Imtiaz, S. (2015). Acoustic Analysis of Back Vowels (/ɒ/ and /ɔ:/) in Pakistani English. Global Journal of Human Social Science Linguistics & Education. (15)11.

Hickey, R. (2005). South Asian Englishes. In Hickey, R. (Ed.), Legacies of colonial Englishes (pp. 536- 558). Cambridge: Cambridge University Press.

Hillenbrand, J. M., Clark, M. J., &Nearey, T. M. (2001). Effects of consonant environment on vowel formant patterns. Journal of the Acoustical Society of America, 109 (2), 748-763. http://dx.doi.org/10.1121/1.1337959

Hung, T. N. (2012). Hong Kong English. In E. L. Low & A. Hashim (Eds.), English in Southeast Asia: Features, policy and language in use (pp. 113–133).Amsterdam: John Benjamins

Kachru, B. (2005). Asian Englishes: Beyond the cannon. Hong Kong: Hong Kong University Press. Kachru, B., & Smith, L. E. (1985). Editorial. World Englishes, 4, 209–212.

Mahboob, A., &Ahmar, N. (2004). Pakistani English: Phonology. In Schneider, E. W., Burridge, K., Kortmann, B. Mesthrie, R. & Upton, C. (Eds.), A handbook of varieties of English, 1, (pp. 1003- 1016). Berlin: Mouton de Gruyter.

Mahmood, M. A. & Farooq, M. (2017). Identification of Triphthongs in Pakistani English. DOI:10.5539/ijel.v8n1p184

Mahmood. A. M. & Farooq, M. (2018). Acoustic Analysis of Front Vowels /Ɛ/ and /æ/ in Pakistani Punjabi English. International Journal of English Linguistics, (8)1

Mesthrie, R. (2004). Synopsis: The phonology of English in Africa and South and Southeast Asia. In E. W. Schneider, K. Burridge, B. Kortmann, R. Mesthrie, & C. Upton (Eds.), A handbook of varieties of English, Volume 1: Phonology (pp. 1099– 1109). Berlin: Mouton de Gruyter.

Mesthrie, R., & Bhatt, M. (2008). World Englishes: The study of new linguistics varieties. Cambridge: Cambridge University Press.

NurRaihan, M., &Deterding, D. (2016). The pronunciation of Brunei English. World Englishes, 35,519–528

Rehman, T. (1990). Pakistani English: The linguistic description of a non-native variety of English. Islamabad: National Institute of Pakistan Studies, Quaid-e-Azam University.

Roeder, R. (2009). The effects of phonetic environment on English /æ/ among speakers of Mexican heritage in Michigan. Toronto Working Papers in Linguistics (TWPL), 31. Retrieved from http://twpl.library.utoronto.ca/index.php/twpl/article/viewFile/6090/ 3092

Schmied, J. (2004). East African English (Kenya, Uganda, Tanzania): Phonology. In E. W. Schneider, K. Burridge, B. Kortmann, R. Mesthrie, & C. Upton (Eds.), A handbook of varieties of English, Volume 1: Phonology (pp. 918–930).Berlin: Mouton deGruyter.

Sheikh, Q. A. (2012). An Analysis of the Vowel Sounds of Pakistani English. Bulletin of Education and Research, (34).pp.1-18

Tayao, M. L. G. (2008). Alectaldescription of the phonological features of Philippine English. In M. L. S. Bautista & K. Bolton (Eds.), Philippine English: Linguistic and literary perspectives (pp. 157–174). Hong Kong: Hong Kong University Press.

Wee, L. (2004). Singapore English: Phonology. In E. W. Schneider, K. Burridge, B. Kortmann, R. Mesthrie, & C. Upton (Eds.), A handbook of varieties of English, Volume 1: Phonology (pp. 1017– 1033). Berlin/New York: Mouton de Gruyter.

Wells, J. C. (1962). A study of the formants of the pure vowels of British English. (MA Thesis) Retrieved from http://www.phon.ucl.ac.uk/home/wells/formants/index.htm