



Acoustic Analysis of the Socio-phonetic Variation in the English Language Long Vowels

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ABSTRACT

The present study investigates the variation in the long English vowels among native English speakers and non-native Pakistani speakers of the English language. The recordings have been collected through e-mail from different regional speakers of Pakistani languages, from U.K. and the U.S., using social-networking. The analysis of the recordings is done using PRAAT software. The long vowel /i:/ was delimited for the study. Durations quoted by the renowned phonetician Daniel Daniel Jones (1976), were used as a reference for the native speakers of the English language. The initial hypotheses were built to analyze the data. The study reveals that native speakers tend to follow the pattern introduced by Daniel Jones with just a slight idiolectal difference. The non-native Pakistani speakers differentiate themselves in the duration of long vowels from the native speakers. Female native speakers have shown significant variation when compared with male native speakers.

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1. Introduction

Languages are complex on the basis of variations. Language variations occur at all levels i.e., sounds, vocabulary, grammar, semantics, and pragmatics. The present study is concerned with variations in the vowel's duration in English. Although there are researches done to set a pattern of English speech sounds yet the variations from speaker to speaker and region to region make it very complex to set one pattern. However, there can always be an average sound pattern.

In order to investigate the variations in the pronunciation, Socio-phonetics provides us the platform where we can mingle social and phonetic variables to analyze how certain sounds vary. Socio-phonetics is a relatively new field of linguistics that combines sociolinguistics and phonetics (Baranowski, 2013). It is interesting to see how social factors involve in the change of pronunciation and accent. Socio-phonetics majorly studies change in the production of similar sounds, variations in the vowels sounds; variations in their frequencies, height, frontness, backness, and durations. Socio-phonetics is closely linked with psycholinguistics, clinical linguistics, and computational linguistics.

The socio-phonetic variation can best be analyzed with the help of Acoustic Phonetics. Acoustic phonetics is the branch of phonetics that study the physical properties of language. The physical properties such as frequency, duration, intensity, and pitch. Descriptions of speech sounds in these terms date back as far as (Willis, 1830), but the invention of the sound spectrograph (1945) was the major technological breakthrough that made the analysis and visualization of the speech signal possible.

There are 12 pure vowels in the English language. 5 vowels are regarded as long vowels which are also termed as Tensed vowels, while others are 7 short or lax vowels in English language. The 3 characteristics of vowels are importance: First is the Height of the vowel i.e., how much high and which part of the tongue is high. We have central, back and front vowels according to the Height and positioning of the tongue in the production of those vowels. One of the most important features is duration of the vowels where we see lots of variation not only dialect-wise but also at the idiolectic level.

The present study focuses on the duration of front long vowel /i:/. In the Received Pronunciation, the speakers tend to shorten the longer vowel before the voiceless consonants. Voicing and devoicing is another feature that we need to consider. A consonant sound is said to be voiced if the vocal cords vibrate when it is produced. If the vocal cords do not vibrate while production, the consonant is said to be voiceless.

There have been many researches on the vowel features of different languages of the world. Many studies have been done in the phonetic features of Pakistani languages. No study has been done to analyze socio-phonetic variation in the English vowel duration between native English and Major Pakistani indigenous language speakers (Shehzadi, 2018). The current study aims to analyze the variation in the vowel duration not only among native speakers of the English language but also makes a comparison with the non-native, Pakistani English language speakers of the regional languages. The hypotheses of the study are as follows;

- All native speakers of the English language tend to shorten the long vowel if it is followed by a voiceless coda and they are expected to produce approximately the same duration quoted by Daniel Jones.
- The difference of pitch between males and females is established, however, the researcher expects no gender-based difference among native speakers of English when it comes to the duration of vowel sound
- The researcher is expecting a huge difference in vowel duration between the two groups of speakers, i.e., Native and Non-Native Speakers.
- The non-Native speakers are expected to make no difference between the duration of the vowels followed by a voiced or an unvoiced coda.

2. Literature Review

Sheikh (2012), in his analysis of the vowel sounds of Pakistani English in global and historical perspective, is of the opinion that Pakistani English has been successfully developed into a non-native variety of English language. Although the variation is not very significant and Pakistani English is close to British English, yet he observes variation in the pronunciation of the vowels of English language.

Ahad, Rahman, and Hamid (2020) and Baidar, Rahman, and Hamid (2020) has studied the acoustic properties of English long vowels produced by Pashto speakers. He analyzed the data using PRAAT software and concluded that Pashto speakers had more problems in producing the longer vowels of English in terms of Height and backness.

Jacewicz and Fox (2015) concluded in their study that regional dialect plays an important role in the variation in vowel duration in American English. The study says, vowels produced in isolation can be successfully utilized to obtain valid samples of socio-phonetic variation in vowel duration (Ahmad, Hashmi, Shehzadi, & Nawaz, 2021).

Holt, Jacewicz, and Fox (2015) has examined variation in vowel duration in African American English relative to white American English speakers living in the same dialect region. And he concluded that African American English vowels were significantly longer than White American English vowels.

Jacewicz, Fox, and Wei (2010) investigated the duration of five American English vowels, those found in hid, head, had, hayed, and hide. The regions selected for the population were the inland North, Midlands, and south and they found that there are significant differences among all these varieties where the longest duration is in the south and the shortest in the Inland North.

Crystal and House (1988) studied durational characteristics of vowel sounds of 3 slow and 3 fast talkers. And they came to an opinion, while comparing their results that previous studies on the same area were not supported by their results.

Johnson and King Jr (1964) is of the opinion that if tense and lax vowels, in terms of whispered vowels, are considered separately; tense whispered vowels are longer than lax whispered vowels.

3. Research Methodology

The recordings were collected using social networking. Participants were contacted directly or indirectly for the purpose of collecting recordings. The participants recorded their recordings in the mobile recorders and emailed me, so that the quality of the recordings might be kept good. In order to make those recordings compatible with the PRAAT software, the recordings were converted from MA4 format to MP3 format using online converting options available on the following website <https://convertio.co/m4a-mp3/>.

Table 1: Details of the Participants of the Study

No.	Participant Name	Native Speaker	Region	Gender	Age	Qualification	Informed consent
01	Ms. Joan Irwin	English	Carlisle/England	Female	55	B. A	YES
02	Robyn Mahoney	English	Birmingham/England	Female	30	A Level	YES
03	Hassan Khan	English	Reeding City/England	Male	24	B. A	YES
04	Eric George Englert	English	Auston, Texas, USA	Male	30	B. A	YES
05	Rawal Malik	Saraiki	Fateh Pur/Punjab	Male	25	BS Hns.	YES
06	Tanvir Ahmed	Balochi	Turbat/Balochistan	Male	39	M.Phil	YES
07	Zareef Iqbal	Sindhi	Tando Jan Muhammad/Sindh	Male	35	M.A	YES
08	Ikramullah Khan	Pashto	Dera Ismail Khan/KPK	Male	33	M.Phil	YES
09	Shaheer Shafiq	Punjabi	Mandi Bahauddin/Punjab	Male	25	M.Phil	YES

4. Data Analysis

4.1 Reference Duration of selected vowels Quoted by Danial Jones (Outline of English Phonetics: §§403,405, Cambridge)

- Seat (0.124 Seconds)
- Seed (0.252 Seconds)

Table 2: Overall Duration

No.	Participant Name	Native Speaker	Region	Gender	Age	Duration /Seat/	Duration /Seed/	Difference of Duration of vowel between two words
01	Ms. Joan Irwin	British English	Carlisle/England	Female	55	0.1947	0.3620	0.1673
02	Robyn Mahoney	British English	Birmingham/England	Female	30	0.1701	0.3000	0.1299
03	Hassan Khan	British English	Reeding City/England	Male	24	0.1566	0.2213	0.0647
04	Eric George Englert	American English	Austin, Texas, USA	Male	30	0.1236	0.2487	0.1251
05	Rawal Malik	Saraiki	Fateh Pur/Punjab	Male	25	0.2303	0.2629	0.0326
06	Tanvir Ahmed	Balochi	Turbat/Balochistan	Male	39	0.2628	0.3112	0.0484
07	Zareef Iqbal	Sindhi	Tando Jan Muhammad/Sindh	Male	35	0.2475	0.3044	0.0569
08	Ikramullah	Pashto	Dera Ismail Khan/KPK	Male	33	0.2515	0.2904	0.0389
09	Shaheer Shafiq	Punjabi	Phalia, Mandi Bahauddin, Punjab	Male	25	0.1526	0.2100	0.0574

One thing we note here is that all speakers vary in their durations. However, as the durations are given in milli-seconds, one can expect slight differences among all speakers. But what has stricken me the most is the notable gender-based difference among the native

speakers. Female speakers have longer durations in both 'Seat' and 'Seed' when compared with the male native speakers. Let's analyse gender-based differences in Table 03.

Table 3: Gender Based Native Speakers Duration

No.	Participant Name	Native Speaker	Region	Gender	Age	Duration /Seat/	Duration /Seed/	Difference
01	Ms. Joan Irwin	British English	Carlisle/England	Female	55	0.1947	0.3620	0.1673
02	Robyn Mahoney	British English	Birmingham/England	Female	30	0.1701	0.3000	0.1299
03	Hassan Khan	British English	Reeding City/England	Male	24	0.1566	0.2213	0.0647
04	Eric George Englert	American English	Austin, Texas, USA	Male	30	0.1236	0.2487	0.1251

A striking feature of this study is the notable variation in the duration of vowel /i:/ is among the male and female native speakers of English. The reason, why female have extended the duration couldn't be analyzed by the researcher as he had no such instrument to analyze. But because we have found a significant difference among male and female native speakers, I have decided to exclude female speakers in my further analyses as I don't have samples from Non-native female speakers to compare with. So, for further analysis I will consider the data from the male speakers only for the discussion and the testing of remaining hypothesis.

Table 4: Local Languages based Comparison of Non-Native Speakers' Duration of /i:/

No.	Participant Name	Native Speaker	Region	Gender	Age	Duration /Seat/	Duration /Seed/	Difference
01	Rawal Malik	Saraiki	Fateh Pur/Punjab	Male	25	0.2303	0.2629	0.0326
02	Tanvir Ahmed	Balochi	Turbat/Balochistan	Male	39	0.2628	0.3112	0.0484
03	Zareef Iqbal	Sindhi	Tando Jan Muhammad/Sindh	Male	35	0.2475	0.3044	0.0569
04	Ikramullah Khan	Pashto	DI Khan /KPK	Male	33	0.2515	0.2904	0.0389
05	Shaheer Shafeeq	Punjabi	Mandi Bahauddin/Punjab	Male	25	0.1526	0.2100	0.0574

The non-native speakers are showing no significant difference in the treatment of vowel duration as minor differences in the milli seconds can be ignored. But in case of Shaheer (Punjabi), we see he has been totally different and his readings are very close to the native speakers.

Table 5: Comparison of Normalized (Average) Duration of Native speakers with the non-Natives

No.	Participant Name	Native Speaker	Region	Gender	Age	Average Native Duration of /Seat/	Non-Native Duration /Seat/	Average Native speaker Duration of /Seed/	Non-Native Duration /Seed/
01	Shaheer Shafiq	Punjabi	Mandi Bahauddin/Punjab	Male	25	0.1401	0.1526	0.2350	0.2100
02	Rawal Malik	Saraiki	Fateh Pur/Punjab	Male	25	0.1401	0.1401	0.2350	0.2629
03	Tanvir Ahmed	Balochi	Turbat/Balochistan	Male	39	0.1401	0.2628	0.2350	0.3112
04	Zareef Iqbal	Sindhi	Tando Jan Muhammad/Sindh	Male	35	0.1401	0.2475	0.2350	0.3044
05	Ikramullah Khan	Pashto	DI Khan /KPK	Male	33	0.1401	0.2515	0.2350	0.2904

It was very important for the researcher to normalize the durations of the native speakers in order to get a clear idea about how much variation in duration the vowel has occurred. Table 5 shows comparison between the average durations of native speakers with the non-native Pakistani regional languages' speakers individually. This comparison helps the researcher analyses the Pakistani speakers individually. We can see that all Pakistani speakers except shaheer, vary from the native speakers in almost the same ratio.

Table 6: Difference of the Normalized (Average) Duration between Native and Non-Native Speakers

Words	Native Speakers Average Duration	Non-Native Speakers Average Duration	Difference
Seat	0.1401	0.2289	0.0808
Seed	0.2350	0.2757	0.0407

Here, the picture becomes clearer because the researchers has normalized the durations of both native and non-native speakers' duration of vowel /i:/ in both words. A significant difference of duration in both words is evident.

Table 7: Comparison of the Over All difference of two words between Native and Non-Native Speakers

Native Speakers Average difference between two words	Non-Native Speakers Average Difference between two words
0.0949	0.0468

One more way to analyze the vowel duration was to compare the difference of duration of vowel between the two words 'seat' and 'seed'. Native speakers delayed the vowel duration in seed by 0.0949 milli seconds while non- natives have just made a slight difference of the duration between two words, which again shows that the variation between native and non-native speakers is prominent.

4.2 Verification of Hypotheses

4.2.1 All native speakers of the English language tend to shorten the long vowel if it is followed by a voiceless coda and they are expected to produce approximately the same duration quoted by Daniel Jones.

The first part of Hypothesis A is approved as we have seen native speakers shortening the long vowel in /Seat/. For the second part of the hypothesis: there is a slight difference which is negligible; hence the second part of the hypothesis is also approved.

4.2.2 The difference of pitch between males and females is established, however, the researcher expects no gender-based difference among native speakers of English when it comes to the duration of vowel sound

Hypothesis B is disapproved as we saw a significant gender-based difference of duration among native speakers

4.2.3 The researcher is expecting a significant difference in the average vowel duration between the two groups of speakers, i.e., Native and Non-Native Speakers.

The individual comparison shows the huge difference in duration except in the case of Shaheer, Punjabi. The research didn't show an overall significant difference, but certainly, both groups vary in the overall durations.

4.2.4 The non-Native speakers are expected to make no difference between the duration of the vowels followed by a voiced or an unvoiced coda.

This hypothesis is disapproved as all non-native speakers did make a difference between the duration of the vowels in the two words. However, the difference is very low if we compare with natives.

4.3 Major Findings

- Male native speakers tend to follow what has been quoted by Danial Jones in terms of long Vowel duration.
- There is a significant difference in the duration of male and female native speakers.
- Non-native Pakistani speakers of different regional languages have almost a similar duration of long vowels with an exception of Panjabi speaker.
- There is clear difference of duration between the Non-native and native speakers of English

5. Conclusion

The researcher conducted research on socio-phonetic variation in the long front vowel of English. More specifically, it was based on a comparison of socio-phonetic variation between native and non-native speakers of the English language. The study was based on 4 hypotheses. 2 male and 2 female speakers were selected to represent the native speakers of the English language. Speakers of 5 major regional languages i.e., Punjabi, Saraiki, Balochi and Pashto, were selected to represent the non-native Pakistani speakers of the English language. However, after the first analyses, the researcher observed a significant difference between male and female native speakers, so, in order to achieve the best possible results, only male speakers were considered for the analysis. Two words 'seat', and 'seed', which represented a particular syllable structure were selected to mark the difference of duration in the long front vowel. The recordings were analyzed in well-known PRAAT software. The study concluded that male native speakers tended to follow what had been quoted by Danial Jones in terms of long Vowel duration; but surprisingly, there was a significant difference in the duration of male and female native speakers. Moreover, non-native Pakistani speakers of different regional languages have almost a similar duration of long English front vowel with an exception of Panjabi speaker. More obvious finding was that there was clear difference of duration between the Non-native and native speakers of the English language.

6. Further Research

The researcher conducted a study which was first of its kind in the Pakistani context, but it has limitations because of the limited availability of resources. The researcher intends to investigate the duration of vowels not only in isolated words but also when these words are uttered in the connected speech. Moreover, Formants Study of the vowels can also be conducted. Further, the investigation in the onsets and offsets durations with more complex syllable structure patterns can also prove to be very interesting. Lastly, the scale of the same research can be broadened with a greater number of participants to validate the results further.

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