Cross Linguistic Acoustic Phonetic Study of Punjabi and Indian English

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Abstract. Punjabi and English are the languages that does not belong to the similar family. For instance, English belongs to the West German languages while Punjabi is a part of the Indo Aryan family. Regional languages have an impact on English in this borrowing and code-mixing process because borrowed words go through a make-up caused by phonetic features of the regional languages. In India, English is the medium of media, science, and technology & its influence on the native languages of the country is significant. This study shows how the regional dialects of the country have a significant influence on the way English is pronounced. It is an effort to define the phonemic changes in Punjabi and Indian English. The purpose of this study was to see if the sound pattern of Indian English varies depending on the speakers' native languages or if it is the same irrespective of the speakers' native languages and also to identify words that differ in pronunciation from Standard English and are clearly marked by an influence of the first language of the native Punjabi speakers of India.

Keywords: Acoustic phonetics · Indian English · Punjabi

1 Introduction

Punjabi is one of India's official languages. Punjabi is the primary official language in Punjab, and it is also spoken in Himachal Pradesh, Haryana and Delhi. Punjabi is considered to be a tonal language. It's because it uses tones to differentiate between words that are otherwise interchangeable [1]. Speakers may experience stress as a result of the influence of their native tongue, which does not have the same verbal delivery as English. According to Nadeem et al. [8], the primary reason of confusion is the natural tendency of first-language Punjabi speakers to utilise tones without specifying stressed syllables. It's an exploratory-qualitative study in which pronunciation discrepancies were suggested by constructing lists based on long-term observation of ignorant native Punjabi speakers. The research is exploratory in nature because no major studies on the same issue could be found (Fig. 1).

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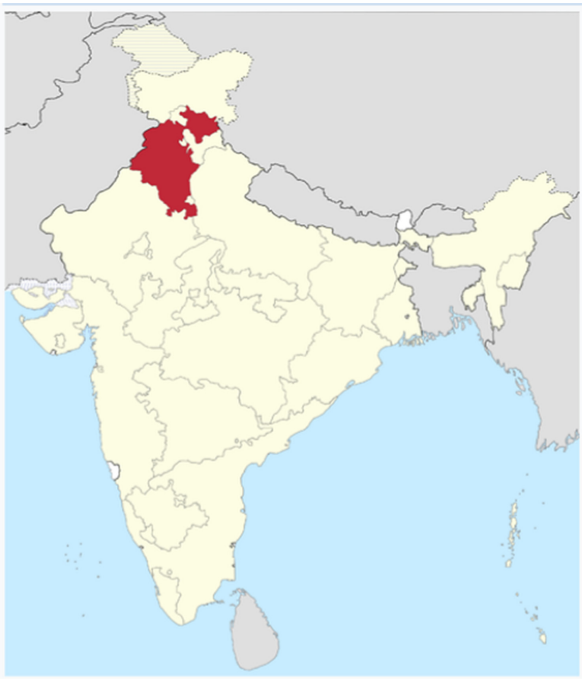

Fig. 1. Punjabi speaking region in India (highlighted in red) [7]. (Color figure online)

The variations of English which originated in the subcontinent of India are known as Indian English (IE). IE is now India's co-official language alongside Hindi. The impact of native language on the phonology of the Indian English was first studied by comparing English uttered by a specific group of Indians to British English [2]. Indian English (IE) has absorbed various traits from India's indigenous languages, according to these studies.

The recent experiments have studied the effects of various native languages on the phonology of IE [3, 4] Even though some differences are identified, the evidence supporting the notion that native speakers from various backgrounds produce a similar level of sound pattern for Indian English language is still strong.

Maxwell et al. studied the acoustic–phonetic properties of IE vowels in Hindi and Punjabi speakers. They were able to identify the differences in the two languages' vowel inventories. Although the IE vowels were produced little variations whereas more phonetic variety in their diphthongs were obtained in Punjabi speakers than those of Hindi speakers [5]. In addition, they found that the English pronunciation of Hindi and Punjabi speakers had the same vowel classifications. The consonant inventory of Punjabi and Indian English is shown in Fig. 2 and 3 respectively:

		Labial	Dental	Retroflex	Palatal	Velar	Glottal
Stop	*Voiceless*	p pʰ	t tʰ	ʈ ʈʰ		k kʰ	
	Voiced	b	d	ɖ		g	
Affricate	*Voiceless*				ʧ ʧʰ		
	Voiced				ʤ		
Fricative		(f)	s (z)		(ʃ)	(x)	ɦ
Nasal		m	n	ɳ	ɲ	ŋ	
Liquid			l r	ɭ ɽ			
Glide		ʋ			j		

Fig. 2. Consonant inventory of Punjabi language [9]

		Place of Articulation						
Manner of Articulation		Labial	Dental	Alveolar	Post-alveolar	Palatal	Velar	Glottal
Nasal		m		n			ŋ	
Stop	Unvoiced	p		t			k	
	Voiced	b		d			g	
Affricate	Unvoiced				ʧ			
	Voiced				ʤ			
Fricative	Unvoiced	f	θ	s	ʃ			h
	Voiced	v	ð	z	ʒ			
Approximant				l	ɹ	j	w	

Fig. 3. Consonant inventory of English language [10]

2 Current Study

In India, people learn Indian English phonology that has the influence of their own tongue or their native language. This argument does not rule out the possibility that IE phonology is influenced by original Indian languages; it only implies that these impacts are historical in nature. To study the perceptual and auditory similarities and variations of IE produced

by native Punjabi speakers, who had all been educated in English medium since high school, we explored the perceptual and acoustical resemblances and differences of Indian English spoken by native Punjabi speakers.

3 Methodology

3.1 Development of Corpus for Acoustic–Phonetic Study

For this study, a phonemically balanced Indian English text database of 60 k words was prepared. Out of these words, we have created 200 phonetically rich Indian English sentences which include all the phonemes. These sentences were recorded by 50 native Punjabi speakers (25 male and 25 female) Punjabi. All the speakers have an educational background in their native language at least up to senior schooling. Speakers were provided with the English sentences and were instructed to speak in their own way of pronouncing the words. All these utterances were recorded using an electret microphone in an office environment by using "Goldwave" recording software at the sampling rate of 16 kHz/16 bit.

3.2 Cross-Language Phonemic Differences

After the perceptual analysis it can be concluded that the pronunciation of Punjabi speakers in the language varies considerably from the English standard in British or North American. Due to the tonal effect of Punjabi, the style of speaking English of native Punjabi speakers was modified and modifications in the sound patterns were discovered as shown in the Table 1.

Table 1. Deviate pronunciation of English phoneme by native Punjabi speakers

S.No.	Actual Phoneme	Deviate Phoneme	Example
1.	**oʊ**	**ʊ**	/ˌkoʊkʊ ˈkʊlɑː/ is pronounced as /ˌkoʊkə ˈkoʊlə/
2.	**æ**	**aː**	/ trænsˈfɔːrmər/ is pronounced as /trɑːnsˈfɑːrmər/
3.	**e**	**/æ/**	/meməri/ is pronounced as /ˈmæməri /
4.	**/ɪ/**	**/ɪː/**	/ˈtemprəri/ is pronounced as /ˈtempəreriː/
5.	**/ʌ/**	**/oʊ/**	/ˈkʌmpəni/ is pronounced as /ˈkoʊmpniː/
6.	**/eɪ/**	**/æ/**	/leɪs / is pronouncesd as /læs /
7.	**/ɔː/**	**/aː/**	/fɔːrm/ is pronounced as /fɑːrəm/

It has also been observed that /ə/sound is added by the native Punjabi speakers between the consonants s/p or s/t, for instance sprite (/spraɪt /) is pronounced along with tonal effect as /səpræt/ . Similarly, /ə/sound is added between various consonants such as horn /hɔːrn/ is uttered as /hɑːrən/ , wolf/wʊlf/ as / vʊləf/ etc.

The spectrograms in Fig. 4 and 5 depicts the pronunciation variation in the English word “college” which is pronounced as “Kaalej” by the native Punjabi speakers respectively.

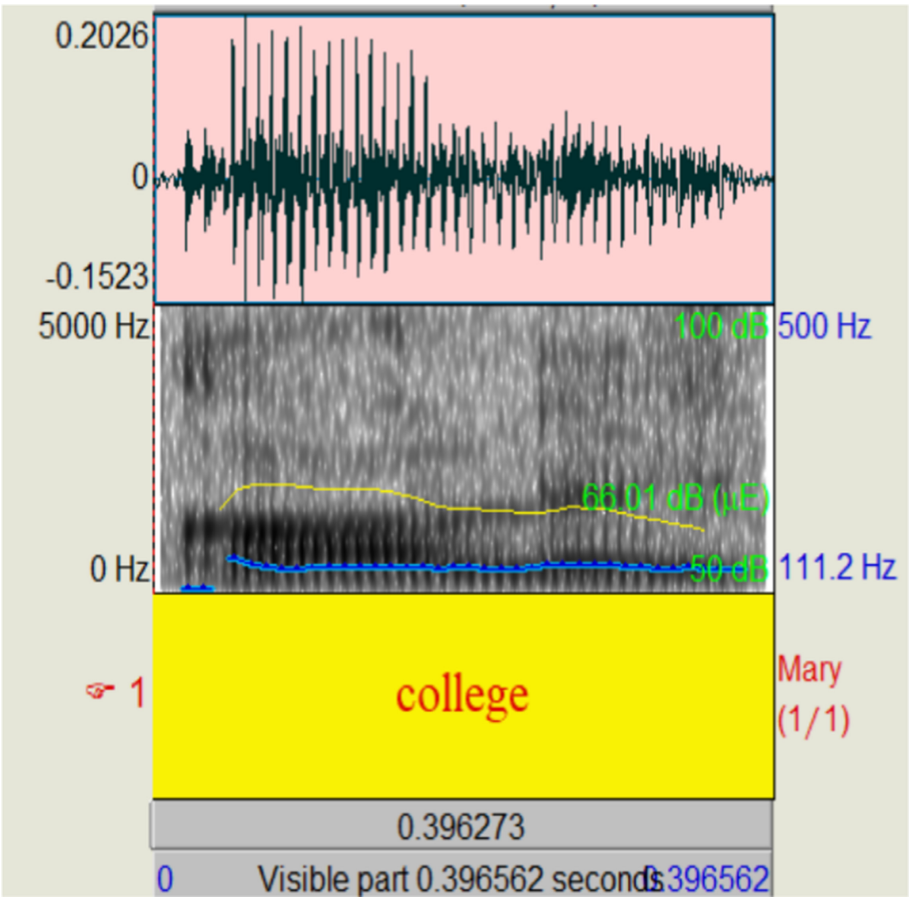

Fig. 4. Spectrogram of the word "College"

3.3 Acoustic Measurements

In the second experiment, impact of speaker background on the distinct segmental and supra-segmental attributes by performing acoustic measurements. The PRAAT speech processing software was used to display recorded utterances and segment them for vowel measurement. At the midpoint of every vowel, F1 and F2 values were extracted instantaneously. Formant values were generalised by using the Lobanov method to analyse the variability based on the vocal tract features of an individual speaker[6]. In the vowel analyses, the dependent variables were normalised F1 and F2, as well as the ratio of F1 to F2.

In Fig. 6, the IE and Punjabi vowels are plotted as a function of speaker background using normalised F1 and F2 values. A comparison of the various vowel spaces represented in the figure shows that, while IE varies due to influence of the speaker's background, the variations between IE and the native language are clearly evident. This analysis was carried out to determine the differences in the sounds that were uttered by

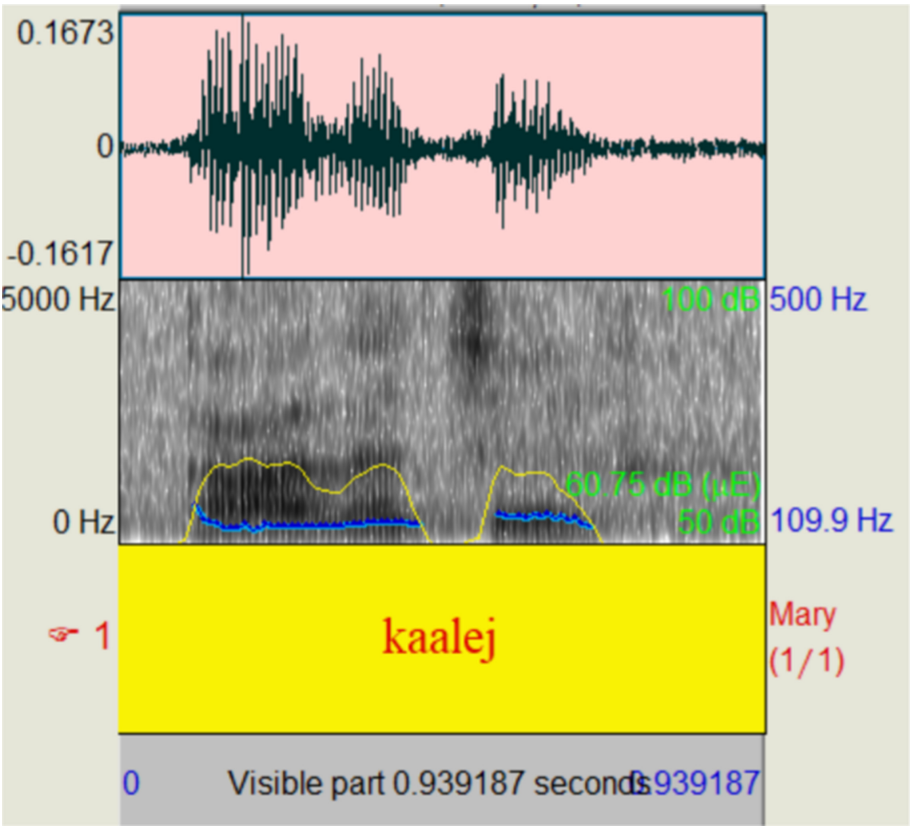

Fig. 5. Spectrogram of the word "Kaalej" spoken by native Punjabi speaker

different speakers. The F1 and F2 studies were carried out to investigate the impact of a language and a speaker background on the generation of certain vowels.

It has been observed from the Fig. 4 that the effect of background is most pronounced among Punjabi speakers. The effect of background on /u/ was most likely caused by the fronted articulation of Punjabi speakers (L1). On the other hand, the effect of language task was more centralized in IE than in L1. Also, the acoustic measurements determined the impact of native language on Indian English. It has been observed that due to the influence of L1 i.e. Punjabi the IE vowels /i/, /e/, /ɑ/, and /u/ get affected.

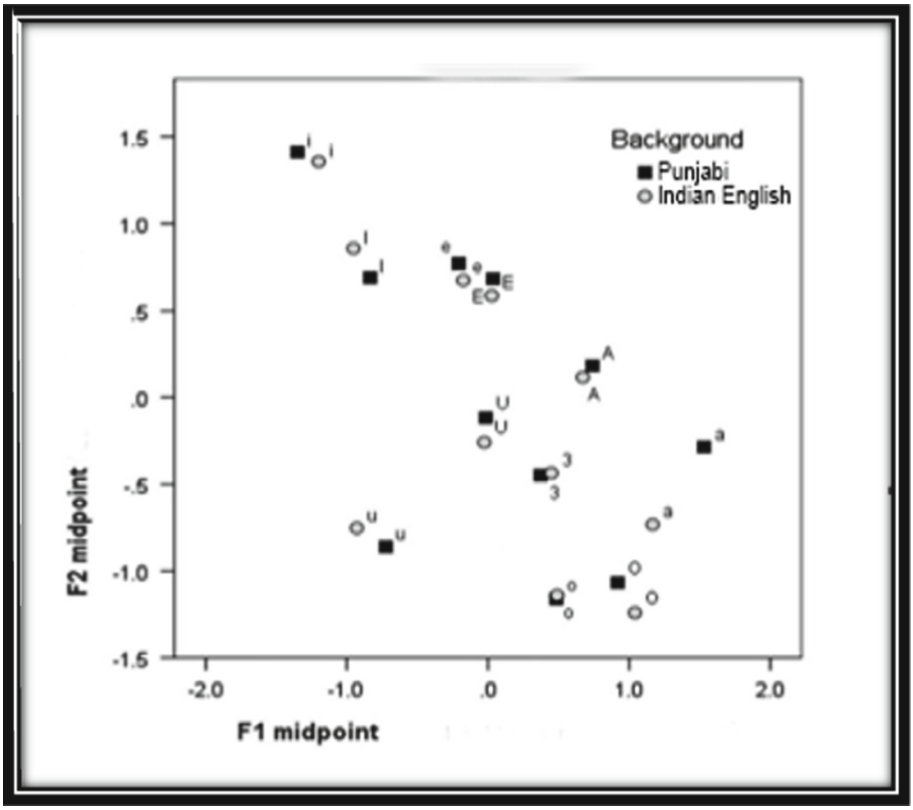

Fig. 6. The comparative analysis of same vowel space is illustrated for IE and Punjabi.

4 Conclusion

It can be inferred that native Punjabi speakers' pronunciation differs significantly from conventional British or American English. The supplemental sound "schwa" is generally added to the words at the initial, middle, and final positions by the Punjabi speakers. This study implies that native Punjabi speakers' pronunciation is punjabicized and distinct in its own manner. Investigating regionally based changes in IE that are independent of L1 would be a complementary future research work. For example, we will intrigued if the Indian English uttered by native Punjabi speakers in places outside the Punjab state differs from that uttered by native Punjabi speakers in Punjab. A study of this nature would help to clarify the distinction between psycholinguistic and sociolinguistic aspects.

References

1. Ghai, W.P., Singh, N.: Analysis of automatic speech recognition systems for indo-aryan languages: Punjabi a case study. Int. J. Softw. Comput. Eng. **2**(1), 379–385 (2012)

2. Bansal, R.K.: A phonetic analysis of English spoken by a group of well-educated speakers from Uttar Pradesh. CIEFL Bull. (Hyderabad) **8**, 1–11 (1970)
3. Maxwell, O., Fletcher, J.: Acoustic and durational properties of Indian English vowels. World Englishes **28**, 52–70 (2009)
4. Maxwell, O., Fletcher, J.: The acoustic characteristics of diphthongs in Indian English. World Englishes **29**, 27–44(. 2010)
5. Agrawal, S.S., Bansal, S., Sharan, S., Mahajan, M.: Acoustic analysis of oral and nasal Hindi vowels spoken by native and non-native speakers. J. Acoust. Soc. Am. **140**, 3338 (2016)
6. Erik, R.T., Kendall, T.: NORM: the vowel normalization and plotting suite (2007). http://ncslaap.lib.ncsu.edu/tools/norm/
7. https://en.wikipedia.org/wiki/Punjabi_Suba_movement
8. Rahman, G.: A comparative study of Pashto and English consonants. Pashto **45**, 11–27 (2016)
9. http://www.languagesgulper.com/eng/Punjabi.html
10. https://psyclanguage.pressbooks.tru.ca/chapter/consonants/