AN ACOUSTIC STUDY OF VOWEL CONTRASTS IN NORTH INDIAN ENGLISH

Olga Kalasnhnik and Janet Fletcher

Monash University and University of Melbourne
olga.kalashnik@calt.monash.edu.au and janetf@unimelb.edu.au

ABSTRACT

The preliminary findings of an acoustic phonetic analysis of the vowels produced by speakers of English as a second language from North India are presented in this paper. Citation-form monophthong productions of a group of male NIE speakers were recorded and acoustically analysed. Results confirm a number of earlier impressionistic observations from earlier studies including the lack of a quality distinction between most tense/lax vowel pairs. North Indian English also appears to illustrate some vowel patterns that suggest it may be a separate sub-variety of IE.

Keywords: Indian English, phonetics, phonology, vowel systems.

1. INTRODUCTION

The term Indian English (IE) is commonly used to refer to English as a second language as spoken in India, Pakistan, Bangladesh, Sri Lanka, Nepal, South Africa, East Africa, the Caribbean, and Britain [1]. In India, English is taught in schools from the age of 6-10 by non-native speakers. Learners of IE do not generally interact with a native speaker variety during the L2 acquisition period. Thus, the ordinary learner of English in India does not get exposed to the use of English to maintain informal, everyday interpersonal relationships in the same community. IE plays the role of *lingua franca*, and due to it self-replicating nature [2] can be referred to as a "transplanted variety".

There has been a substantial amount of research conducted on the phonology of IE ([3] [4] [5] [6]). The first attempt to present the system of consonants and vowels of IE spoken in the sub-continent was the introduction of the Generalized Indian English (GIE) model [7] [3] followed by a model of the phonological system of Educated Indian English used for the purpose of teaching English in India [8]. Three descriptions of the vowel system of IE as a distinct variety were also described by [1], [9], and [10].

Given the findings of the previous research, the most prominent features of the IE vowel system which may be applicable to NIE are listed below with reference to Wells' lexical sets [1]:

a) substitution of the diphthongs for the FACE vowel /eɪ/ and GOAT vowel /oʊ/ by the monophthong vowels [eː] and [oː] ([8] [1] [9] [10] [5] [6]);

b) the absence of the back mid THOUGHT vowel /ɔː/ ([3] [7] [9] [8]);

c) and the presence of full unreduced vowels in weak syllables instead of the schwa ([3] [1] [10]).

Other prominent features of Indian English also include the lack of contrast between TRAP and DRESS vowels ([10] [11]) and the absence of a quality contrast e.g. between FOOT and GOOSE ([5] [6]).

With the exception of some studies ([8] [5] [6]), most of the above findings are based on impressionistic observations and few studies have included acoustic analysis of IE vowel patterns. Also given the linguistic diversity on the sub-continent it is also possible that there may be more than one variety of IE. More recent findings ([5] [6]) showed significant influence of L1 phonology on IE, and presented distinctive sub-varieties within the general IE model raising the issue of defining those varieties either by L1 of the speakers, or by membership of the same language family.

In this paper, we present preliminary results of a phonetic analysis of vowel production of English as spoken by speakers of English as a second language from North India. It forms part of a larger study which investigates phonetic and phonological features of vowel production of a group of speakers of English from North India.

This paper will focus on the realisation of the tense-lax vowel contrast by the speakers.

2. METHODS AND MATERIALS

2.1. Subjects

The subjects in this study were seven male speakers from North India. They were all in their mid-twenties at the time of recording who spoke English as a second language and had studied English since primary school. All were university educated. Three of the subjects spoke Hindi as their first language. The other four subjects were bilingual in Hindi and Punjabi. At the time of data collection, the estimated time of residence in Australia for all the subjects did not exceed eight months.

2.2. Materials

The list of words used for the study was taken from a standard list used to record vowel contrasts in Australian English [12]. Table 1 lists the core tokens analysed in this study and the Australian English phonemic representation of each vowel. Additional words illustrating the FACE, GOAT, and HAPPY vowels (after the English lexical sets from [1]) were also recorded. The main tokens analysed in this study are listed in Table 1.

Table 1. List of words used in the analyses and their Australian English Phonemic classification.

Word	Vowel	Word	Vowel
Heed	i	Hod	ɒ
Hid	ɪ	Head	ɛ
Had	æ	Hud	ʌ
Hard	a		
Herd	ɜ		
Ahead	ə, ɛ		
Horde	ɔ		
Who'd	u		
Hood	ʊ		

2.3. Recording and Analysis

The subjects were recorded in a quiet room using a Sony Walkman Professional recorder and a multidirectional stereo Sony microphone. They produced five repetitions of the word list and were

asked to pause after each word. Each subject was recorded by the first author in a quiet room. The recordings were digitised on a Dell computer using PRAAT (version 4.2.09[13]) and the digitised files were then analysed using EMU (Cassidy & Harrington, 2001 [14]). Formant tracks were extracted using EMU and the vowels were annotated using the acoustic waveform and wideband spectrogram. Formant tracking errors were corrected by hand. Each vowel was labelled using MRPA ('machine readable phonetic alphabet'). Vowel segments were identified and labelled from the onset to offset of regular formant activity associated with the vowel. The acoustic vowel 'target' was also marked where there was least movement of F1 and F2, i.e. the steady state was identified for each token. It was important to add extra symbols to reflect a more extensive range of vowel realisations. This was particularly relevant for the tokens FACE and GOAT. The speakers realised these vowels consistently as monophthongs rather than diphthongs.

Mean F1 and F2 frequencies of the vowel targets were extracted at the measured target points using the EMU/R analysis suite. Euclidean distances were calculated to test the level of contrast between tense and lax monophthong pairs (e.g. "heed" versus "hid"), and also in cases where there appeared to be a large degree of overlap between adjacent vowel categories. Statistical analyses of the data were then performed using the 'R' statistical program (version 2.4.1).

3. RESULTS

Figure 1 shows mean F1 and F2 values of monophthongal vowels averaged across the seven speakers of NIE analysed in this study. Speakers are clearly producing distinct vowel targets for certain tense/lax monophthong pairs. In particular, a comparison of the Euclidean distances between the centroids of the GOOSE /u/ and FOOT /ʊ/ vowels suggests a contrast is produced by speakers (t=4.103, p<0.0001). Likewise, speakers produce the KIT /ɪ/ and FLEECE /i/ contrast (t=7.012; p<0.0001) and the STRUT and BATH contrast (t=4.58, p<0.001). Most realisations of the BATH vowel are open back [ɑ], and the mean F1/F2 values for the STRUT vowel are much more central then a back unrounded /ʌ/ vowel,

suggesting the open-mid central vowel [ɐ] transcription as a more appropriate for this vowel.

Figure 1 also shows a distinction between GOAT (which was always realised as a tense monophthong rather than a diphthong) or "horde", and "hod". However, not all speakers produce a clear contrast between these vowels. The vowel inventories of two of the speakers do not include the "hod" vowel. Moreover, the vowel in "horde" is always rhotacised and shows a great deal more variation than GOAT. There is a large degree of inconsistency in the realisation of the back vowels amongst the speakers in general. The token "hod" is produced as [o] or [u] for three speakers. For most speakers the "horde" vowel is phonetically closer to the close vowel /u/. Figure 2 shows ellipse plots for one of the speakers who produces a mid low vowel [ɔ] (i.e. CLOTH). For this speaker, however, there is a high level variation in the realisation of the vowel which is a strong reflection of the varied pronunciation of the target words "hod" "goat" and "horde" in this corpus. Further investigation of these back vowels is in progress.

Figure 1. Mean F1 and F2 of North Indian English vowels, averaged across speakers.
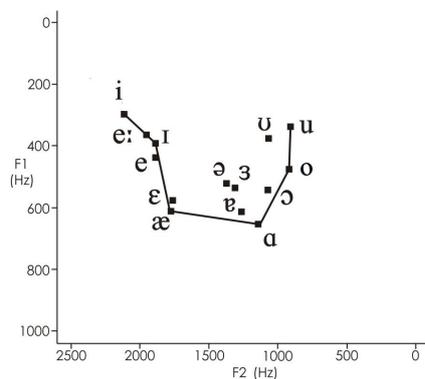

There is also overlap between the vowels produced in "FACE", "HAPPY" and "KIT". The first two vowels are realised consistently as [e:], or [e] in the corpus, with a high level of overlap with the vowel produced in "KIT". Speaker YP (Figure 2) is typical of most speakers in the corpus. The inter-euclidean distances between the centroids of [ɪ] and [e] are not significantly different (p>0.05), but the reverse holds for [e] and [e:] (t=3.15, p<0.05).

The DRESS and TRAP vowels show a high level of overlap for all speakers. There is no significant difference between the Euclidean distance between the centroids of these two vowels /æ/ and /ɛ/ for any speaker (p>0.05). This is also clearly illustrated in Figure 2.

Figure 2. F1/F2 Ellipse plots for the vowel target position for monophthongs of NIE produced by Speaker YP.
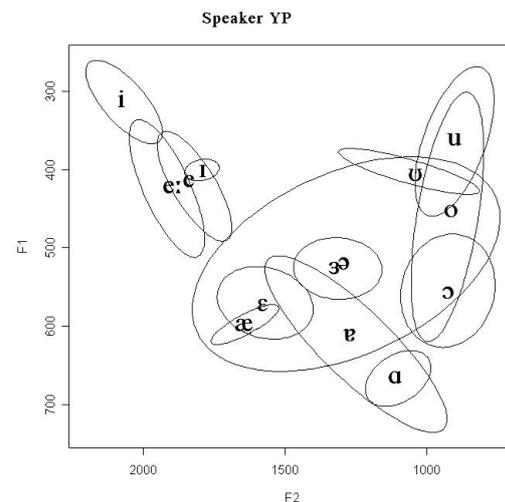
Not all speakers make a contrast between the tense central NURSE vowel ("heard") and the initial unstressed vowel in "ahead" (p>0.05) as shown in Figure 1. The unstressed initial vowel of "ahead" is produced as a more open vowel which overlaps somewhat with the STRUT vowel [ɐ] although a comparison of the inter-euclidean distances of these two vowels reveals there is a weakly significant difference between the these two vowels (t=2.28, p<0.05).

4. DISCUSSION

The vowels produced by the NIE speakers in this study show many similarities to the conventional models of IE. The speakers in this study produce the KIT ɐɪɒ vs. FLEECE ɐɪɒ contrast. However, for some speakers there is an overlap of the vowels /e/ and /ɪ/. Earlier studies have suggested that IE speakers maintain the opposition /ɛ/ vs. /æ/, even if their L1 lacks the phonemic distinction [1] [7] [9]. However, similar to the observations of [1] that L1 speakers of Punjabi do not maintain this opposition, our results showed no distinctive F1/F2 differences between the vowels /ɛ/ and /æ/. Previous descriptions

([8],[1]) also propose that the IE speakers use a "frontish" low vowel in BATH, /a/. However, the results of this study showed that all the NIE speakers use a back vowel /ɑ/ instead of a front or central-front open vowel /a/.

It has also been suggested ([3] [8]) that the open-mid back vowel /ʌ/ is used instead of the central vowel /ə/ in unstressed and unaccented position in words, or, alternatively that the three vowels /ʌ/, /ɜ/, /ə/ have only one corresponding vowel /ə/ ([8]). The results of this study partially support the latter. The vowels /ɜ/ and /ə/ are produced with almost identical quality although speakers produce a distinctive "hud" vowel although there is a certain degree of inter-speaker variation. The NIE speakers in this study do not consistently produce a mid central vowel in stressed and unstressed environments, with many speakers producing a vowel that is more open and central.

In IE the status of the /ɔ/ vs. /ɒ/ opposition has been questioned ([1]), and earlier studies on IE have reported either the absence of a back mid vowel /ɔ/ ([3] [9]), or the substitution of /ɔ/ for /ɒ/ ([8] [9]). This lack of clarity is also reflected in our preliminary analysis of these data. There is no evidence of a phonetic low back rounded vowel, and inconsistent realisations of the mid back rounded vowels which may be due to the choice of experimental tokens in this study. The "horde" and "hod" tokens are realised differently among the speakers. The three vowels /ʊ/, /u/ and /o/ also show significant overlap, although the differences between the close rounded lax and tense vowels are more robust than for the mid back vowels, echoing similar findings in two previous studies ([5] [6]).

5. CONCLUSION

North Indian English appears to illustrate vowel patterns that suggest it could be a separate sub-variety of IE. The preliminary acoustic results presented here suggest that standard GIE systemic vowel transcriptions or proposed earlier different model transcriptions of Educated Indian English may need to be modified to incorporate potential varietal differences. These include the use of an open back /ɑ/ and the open-mid central /ɐ/; the absence of /ɒ/; lack of the contrast between /ɛ/ and /æ/; and the significant overlap between the back vowels /u/, /ʊ/ and /o/ suggest that these differences are less clear cut than indicated in earlier impressionistic investigations. However vowel length was not examined here. This will be investigated in the near future, and further analyses of the back vowels are in progress. In addition, the effects of prosodic features and stress on vowel production will be examined in a separate study.

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