Comparison of accent features embedded in Chattisgarhi and Khariboli Dialect of Hindi for Forensic Speaker Profiling

M Kulshreshtha, C Singh, R Sharma

Citation

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Abstract

Accent features of an individual are always influenced by the native accent while speaking non-native language. Regional dialectal accent is always reflected as a speaker profile characteristic, which is one of the important features used to provide clues in the course of investigation through recorded speech. As a part of research on these characteristic features of regional dialectal accent, experiments have been conducted on the native accent of Chattisgarhi speakers as compared to the accent features of Khariboli speakers. Chattisgarhi is one of the popular dialects of Hindi, spoken in Chattisgrah (state province of central India). Important lexical and sentence prosodic features of speech data of 15 Chattisgarhi male speakers are studied with reference to the Khariboli speakers' speech data. Vowel quality and quantity of Chattisgarhi dialect are also distinguished from that of reference dialect. Specific acoustic features of Chattisgarhi based on the prescription model, are found unique in the characterization of speakers belonging to the regional dialectal group. Some of the accent features, in terms of intonation and tonal characteristics, are reported in the paper as speaker profiling characteristic features based on the dialectal accent and proved to be important to narrow down the field of investigation.

Name of the Department Where the work was done: Central Forensic Science Laboratory, Directorate of Forensic Science, Ministry of Home Affairs, Government of India, Chandigarh-160036, India

INTRODUCTION

Speaker profiling includes the extraction of individual information about the anonymous perpetrator from incriminated speech material like sex, age, dialect, features of respiration, phonation, articulation and manner of speaking etc. [8]. Abberton et-al in 1978 reported in a study that a person's identity can be profiled as belonging to a regional dialectal group or categorized according to the language s/he speaks. [1]

If recorded speech is available as evidence in the event where suspected culprits are not available, dialect accent of an individual plays an important role in the course of crime investigation. It carries the information related to a caller in terms of accent features. These features from recorded speech have the potential as important clue for the investigator in order to narrow down the field of investigation.

A specific dialectal accent of an individual reflected in his speechis due to different uses, pronunciation, style and vocabularies used in the dialect. On the other hand, dialectal accent of a person also depends upon the educational background, mother tongue and the regional language of area where s/he is living for last many years. In India, most of the people are bilingual, especially those living in the boarder areas. In fact, the non-native language is always affected by the native dialectal accent of the person.

In view of the importance of speaker profiling in the course of investigation based on the dialectal accent, studies on the accented features in terms of acoustic parameters have been conducted on some of the popular dialects of Hindi namely, Khariboli, Bhojpuri, Bundeli, Chattisgarhi, Kanauji, Marwari and Haryanvi.

This research paper demonstrates and discusses the findings of the study on Chattisgarhi, which is one of the popular dialects of Hindi, spoken in the state provinces of chattisgarh by considering Khariboli as reference dialect. Some of the acoustic features based on the accent features are identified for characterization of chattisgarhi speakers as compared to the Khariboli speakers.

SPEECH MATERIAL/ INFORMANTS

A specific text has been prepared for this study containing the words commonly uttered by the criminal while committing offences like bribery, kidnapping for ransom and threatening calls etc. and it has been used for recording the speech exemplars of informants of the chosen dialects. This text has also been transliterated for Chattisgarhi dialect (uses as well) in order to get the pure accented features of the regional dialect reflected in the speech of informants.

Five Hindi vowels have been chosen for study and closed syllables containing these vowels as nuclei are selected for the purpose of experiments. Table (A) shows the syllables selected for the study with C_1VC_2 structure to study the vowel quality and quantity of Chattisgarhi speaker w.r.t Kahariboli speakers. Consonants C1 and C2 are selected in order to make a sensible token.

Figure 1

Table A: words chosen to study the vowel quality and quantity of chattisgarhi speakers

Selected Word (C_1VC_2)	Vowel	Description of the vowel
/kʌl/	/ʌ/	Open –mid back unrounded
/bat/	/a/	Open back unrounded
/tʰik/	/i/	Close front unrounded
/kon/	/o/	Open- mid back rounded
/tum/	/u/	Close back rounded

The Recorded speech samples have been subjected to auditory analysis and a sentence and a word segment have been chosen to study the intonation/tonal characteristics of Chattisgarhi speakers using prescription model.

EXPERIMENTS

Spectrographic analysis of the speech samples has been performed with computerized Speech Laboratory (CSL) Model 4300B and formant frequencies have been measured in order to study vowel quality and quantity of five vowels mentioned above. Length of syllabic nuclei for the chosen syllables has also been compared.

Prosodic analysis based on the prescription model has been conducted to study the intonation pattern of chattisgarhi speakers and tonal characteristics have also been compared with that of Khariboli.

RESULTS AND DISCUSSION

Fig.1 shows the intonation pattern of one of the Chattisgarhi speakers and Fig.2 represents the intonation pattern reflected among Khariboli speakers. It is clear from Fig.1 that Chattisgarhi speakers produce 'L H L H L' (L- Low, H-High) pattern as sentence prosody. On the other hand, Khariboli speaker while speaking the same sentence shows an intonation pattern of 'H L H L H '. While considering the intonation of all 15 speakers belonging to Chattisgarhi and Khariboli dialect group, it is observed that around 70% of the Chatttisgarhi speakers reflects the pattern bounded between two low points (L) of pitch variations; on the contrary 65% of the Kahriboli speakers shows the pattern bounded between two high points (H) of the pitch variation. These intonation patterns are considered as the generalized intonation pattern for the groups.
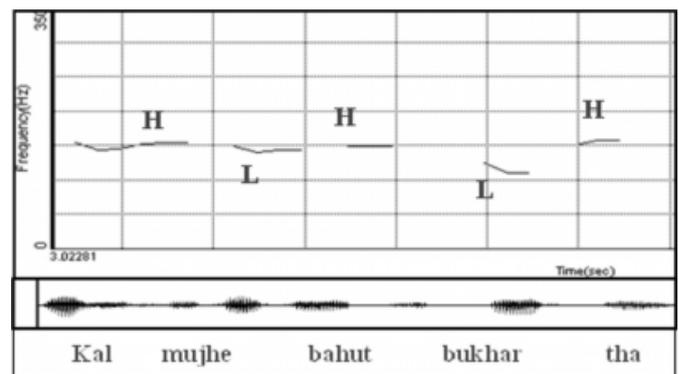
Figure 2

Figure 1: Intonation pattern of Chattisgarhi speaker
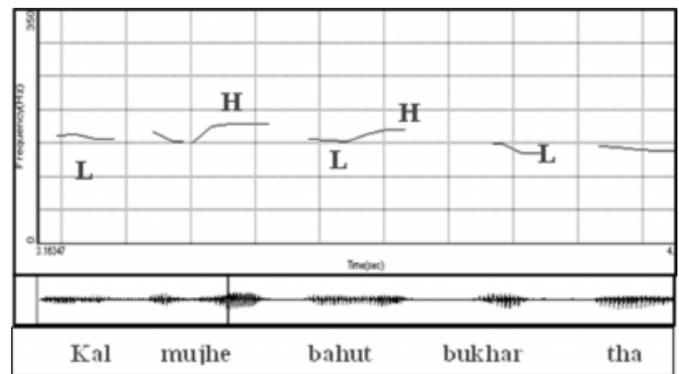
Figure 3

Figure 2: Intonation pattern of Khariboli speaker

Cummins et-al. in 1999 studied lexical and sentence prosodic features for identification of accented feature of a dialectal group or language and reported that lexical tone and phrasal intonation is an important marker of accent and stress in every language [2].

Figure 4

Figure 3: Tonal characteristic in chattisgarhi speaker
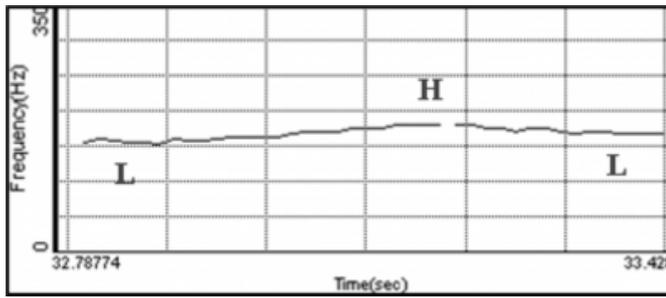
Figure 5

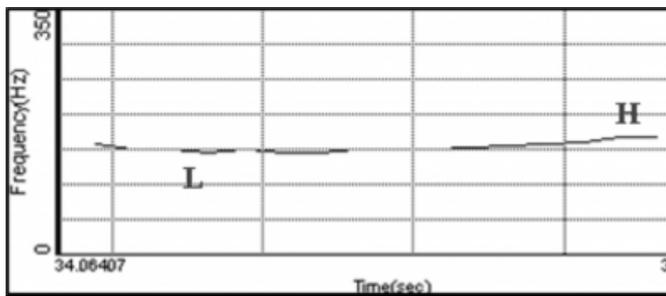Figure 4: Tonal characteristic in Khariboli speaker

Fig. 3 and Fig. 4 shows the tonal characteristics of the speakers in Chattisgarhi dialects and Khariboli dialect respectively. Fig.3 shows the rising- falling tone [L H L] for a selected word of the Chattisgarhi speech whereas; Khariboli speakers show a rising tone [L H] while studied on a similar word.

Study conducted by the authors on the speech data of Bhojpuri dialect speakers w.r.t. Khariboli speakers have also revealed that the lexical and sentence prosody can be used for speaker profiling as far as accent features are concern [9]. Bhojpuri and Khariboli dialects are found distinguishable on the basis of accent features of the dialectal group.

In another experimental study vowel quality has been measured for all Chattisgarhi and Khariboli speakers as well. It has been observed that 13% of speakers belonging to Chattisgarhi group have shown similar vowel quality like Khariboli speakers for vowel /^/. On the other hand, 40% and 26% of Chattisgarhi speakers produce vowels /a/ and /u/ similar to that of produced by Khariboli speakers. However, the vowel quality of /i/ and /o/ of Chattisgarhi has shown a significant difference from that of Khariboli. It has been revealed from the experimental results that the vowel /i/ and /o/ has the maximum discriminating power to distinguish the accent features as far as the vowel quality of a dialect is concerned; whereas other vowels /^/, /u/ and /a/ have lesser discriminating power.

Figure 6

Figure 5: The Formant chart showing the average formant frequencies for 15 male speakers of Chattisgarhi and Khariboli dialectal group.
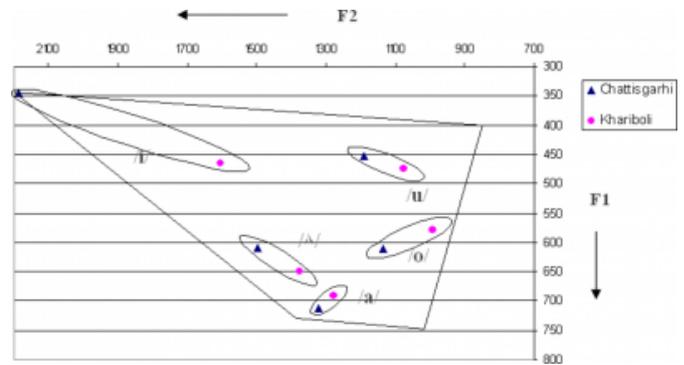

Vowel quality of a Chattisgarhi and Khariboli dialectal group is represented with the average value of 15 informants represented by first/second formant frequencies, for the nuclei of words chosen as shown in Fig. 5. Vowel quality for Chattisgarhi is found distinctive from that of the Khariboli group. The vowel quality of Chattisgarhi for close front unrounded vowel /i/ is found very close to the cardinal point defined by Daniel Jones in 1957[3] as observed in Fig.5. On the other hand, the vowel quality for similar vowel is towards close mid central point in case of the khariboli group. While comparing the vowel quality of both the groups, it is found that the Chattisgarhi speakers have a tendency of shifting the vowels towards the central area of the vowel quadrilateral.

Length of syllabic nuclei of five selected words has been compared on the average values of Khariboli and Chattisgarhi as shown in Fig. 6. It is revealed that the vowel length of the Khariboli speakers is shorter than that of Chattisgarhi group concluding that Chattisgarhi speakers use longer vowel as compare to the Khariboli speakers.

Figure 7

Figure 6: A comparative chart of the vowel length for Chattisgarhi speakers w.r.t. Kahriboli speakers
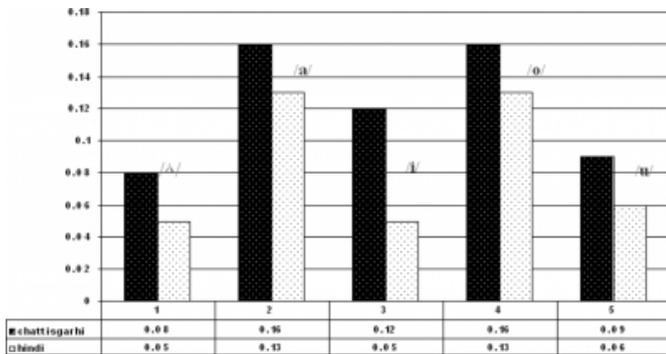
CONCLUSION

Based on the results of our study, the speaker profiling information associated with dialectal accent is found specifically distinctive. Specific acoustic features of Chattisgarhi based on the prescription model of prosody are found unique for characterization of speakers belonging to the regional dialectal group. Acoustic features associated with lexical and sentence intonation are found unique to a dialectal group and found useful for speaker profiling. Thus, proved to be important to narrow down the field of investigation. Front vowels' quality expressed in terms of first and second formants are shown more efficient than the back vowels. Overall distribution of vowel quality on vowel quadrilateral is important in speaker profiling study of an individual. Though there is possibility of change scenario in accent feature due to exposure to other non-native dialects, accent features are likely to remain as profile characteristic for quiet some time.

A large-scale study is recommended considering the factors of variability within the dialectal group as a regional accent. In nutshell, accent features proved to be important as a speaker-profiling characteristic in order to identify the dialectal accent of unknown caller among the Hindi speakers.

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Author Information

Manisha Kulshreshtha, Ph.D.
Post-Doctorate assistant, Haskins Laboratory

Chongtham Pureihanba Singh, PhD
Assistant Director, Physics Division, Forensic Science Laboratory

Rakesh Sharma, Ph.D.
Professor, Department of Forensic Science, Punjabi University