RESEARCH ARTICLE

Sociophonetic Conditioning of f0 range Compression in Nepali

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ABSTRACT

The present study accounts for the fundamental frequency (f0) perturbation of stop types in Nepali spoken in the Maram region of Manipur, India. Two different experiments were performed on the speech of the native speakers of Nepali in order to investigate if the f0 perturbation following the stop types would be affected due to contact with tonal language, Maram. We found that the Nepali speakers maintained four way stop contrast: voiceless stop (VS), voiceless aspirated stop (VLAS), voiced stop (VS) and voiced aspirated stop (VAS) despite being in contact with Maram for a very long time. We also found that the f0 range was greater leading to f0 compression for speakers with high level of proficiency (LOP) in Maram due to extensive language contact.

Keywords: sociophonetics, f0, f0 range, gender, LOP, Nepali

1. Introduction

Fundamental frequency (f0) has been considered to serve as a key marker for a number of paralinguistic and extra-linguistic functions. Studies on f0 perturbations have been well established across languages featuring in tonal and non-tonal languages alike.

Established work related to f0 perturbation draws on two distinctive theories governing f0 perturbation. Cross-linguistically, voiced obstruents have been found to lower f0 in the following vowel House and Fairbanks[4].This lowering has been attributed to physiological and phonetic factors by few Stevens[11], while some argue that f0 lowering following voiced obstruents serves to maintain a phonological contrast between voiced and voiceless obstruents, Kingston & Diehl[5].We will pay particular attention to voiced stops and voiced aspirated stops in order to examine if the f0 following the two stop types is consistent in maintaining the perturbatory effect despite being in contact with a tone language for a long time. The study presented here looks at social factors: age, gender, level of proficiency (LOP) ethnicity, intra-inter-lingual contact and change at the phonetic level and also seeks to understand the ways in which social identities and beliefs shape and influence speakers' ability to identify, comprehend and as well as socially evaluate varieties.

2. Method

2.1. Note Task: The recorded materials for the present research were elicited from native speakers of Maram Nepali, born and brought up in Maram. the recording materials included stops (labials, dentals, velars and retroflex) and the sentences were written in Devanagari script. Each sentence was used in two different contexts, namely phrase initial (focus) and phrase medial (non-focus) contexts to maintain consistency in their recordings.

The recordings were made using a head mounted AKG C420 III pp microphone. After the completion, the recorded data were then digitized at 22050 Hz. This process was followed by segmentation and annotation of the data starting from zero crossing, and this involved identifying the beginning and end of segmental features whereby several acoustic cues were taken into consideration, for instance: closure duration, burst, period of vowel duration, aspiration, stop-type, place of articulation and context as in initial and medial position. Next, analysis involved running Prosody Pro, a praat[1] script that gives systematic prosody analysis for accurate pitch tracking of the f0, including f0 maximum and f0 minimum values. f0 range was then calculated as {f0 maximum- f0 minimum}.

2.2. Participant Speakers: Twelve native Nepali speakers (6 male and 6 female) born and raised in Maram were chosen for the recording task. All participants were between the age group of 30 and 55.

2.3. Acoustic Parameters: The experiment involved segmentation and annotation of the data in Praatstarting from zero crossing, and this involved identifying the beginning and end of segmental features whereby several acoustic cues were taken into consideration, for instance: closure duration, burst, period of vowel duration, aspiration, stop-type, place of articulation and context as in initial and medial position. Variability of f0 was calculated with the standard deviation (SD) of each task. A z-score f0 value in addition to normalizing the gender effect also allows us to represent each f0 value in terms of number of standard deviations away the value is from the mean. Intra/Inter speaker and token variation in f0 contours were normalized by taking 10 measures of f0 starting at 10 percent and ending at 100 percent of the vowel. The sorted data were fed in R Studio for statistical analyses and with the following variables listed: Zf01, Zf02, Zf03 (referring to the z-score normalized values of 10%, 20% and 30% of the initial portion of the vowel), stop type, subject, level of proficiency (LOP).

3. Results

3.1. General Observations

We have designed three level of proficiency (LOP) scale for Maram: high, medium and low, corresponding to LOP in Maram with two stop type: VS and VAS. The plots displayed below give the Zf0 normalized value in relation to the two stop type: voiced stop (VS) and voiced aspirated stop (VAS). The Zf0 labelled as Zf01, refers to the normalized value of initial 10%, Zf02 to 20% and Zf03 to 30% of the vowel portion that show lower mean, following the two stop type considered for the study.

We found that speakers were able to maintain the voiced and voiced aspirated distinction of stop types despite their high LOP in Maram. The f0 following the VAS production was significantly lower compared to VS in all the three experiments performed.
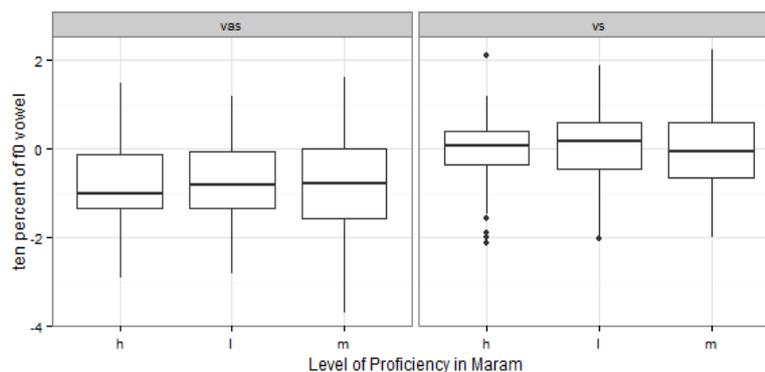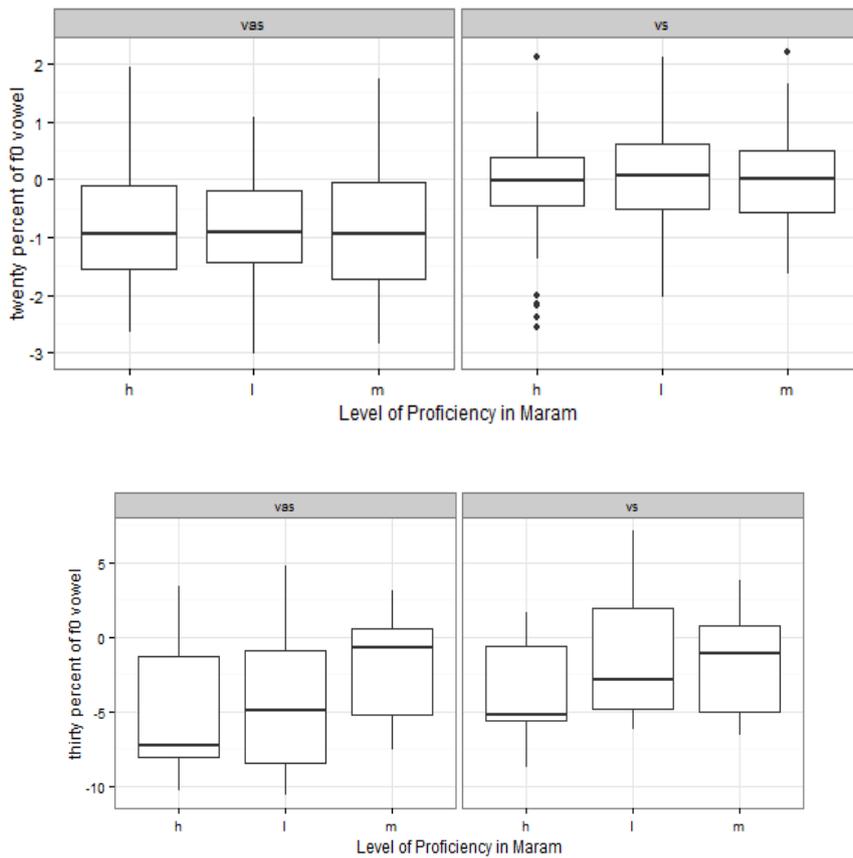
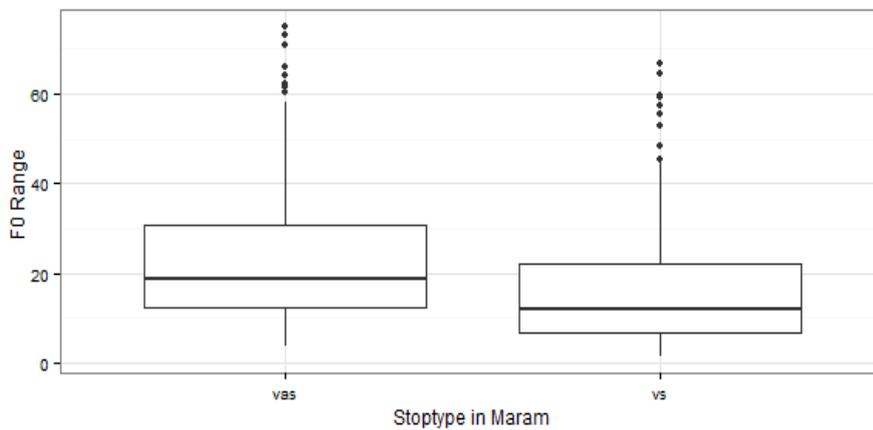Figure 1. Effect of LOP on VS and VAS (ZF01, ZF02, ZF03)

Figure 2.   f0 range of VS an VAS for high (LOP) speakers

As displayed in the plot above, the f0 range of high LOP in Maram as a result, in the process of maintaining the stop distinction exhibited greater f0 range leading further to f0 compression for the VAS production for speakers with high level of proficiency in Maram.

4. Discussion

We identified several acoustic and non- acoustic cues of f0 perturbation in Nepali. The results stay consistent with established works in Hindi, Dutta[2] and Marathi, Patil & Rao[7]. The fact that speakers maintain f0 perturbation related to certain stop types with respect to certain social factor (level of proficiency) and acoustic

cues (f0, f0 range) points to cross-linguistic tendencies as how they can be phonetically and cognitively implemented. Even though the high LOP in Maram had no effect on the f0 of the two stop types, yet, the f0 range compression amounted greater for VAS production for high LOP speakers.

5. Conclusion

Our results indicate that f0 perturbation patterns follow universal claims, in that VAS lowers f0 more than VS. However, high level of contact (LOP) and proficiency with a tonal language result in greater f0 range compression in VAS compared to VS. These findings lend support to the claim that physiological and phonetic factors determine f0 perturbation in the following vowel but sociophonetic conditions such as high LOP result in f0 range compression. We have established that sociophonetic conditioning crucially impact diasporic Nepali speakers' f0 range, while maintaining automatic, physiological and voicing dependent conditioning of f0 perturbation, especially for speakers with high level of proficiency in a tonal language.

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