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Laryngeal contrast and tone in Tamang: A preliminary study

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1. Introduction

Tamang is a Sino-Tibetan language spoken mainly in Nepal. The Nepal census conducted in 2011 reports that there are 1.5 million speakers of Tamang language, which is the fifth largest among more than ninety languages spoken in Nepal.

Following the phonetic and phonological descriptions of Tamang by Mazaudon (1973), Tamang has been described as a language with contrastive tones. Interestingly, there are conflicting claims regarding laryngeal/tonal contrast of Tamang stops. Mazaudon describes that Tamang has four tones with distinctions in pitch and voice quality: Tone 1 (high falling pitch) and Tone 2 (high level) have modal whereas Tone 3 (low level) and Tone 4 (low-rising) have breathy phonation. Further, she claims that aspiration contrast is observed only in Tone 1 and 2 words, and Tone 3 and 4 can be voiced (Mazaudon 2014). Varenkamp (to appear, cited in Lee 2011), on the other hand, reports there are no phonemically voiced stops as none of Tamang stops are acoustically voiced. On the contrary, Yonjan (1993) argues that there is a 3-way contrast of aspirated/unaspirated/voiced stops without assuming phonological tones. Yet, the acoustic aspects of the Tamang sound system have not been fully investigated. In the current study, we focus on the phonetic realization of stops, and examine the laryngeal contrast of this relatively understudied language, with special attention to tones.

2. Method

2.1. Recording

Seven stop-initial monosyllabic words were taken from Yonjan (1993), as shown in (1).

(1) Target words

be(ji)	‘done’
da(ji)	‘clean’
ge:	‘work’
ta(ji)	‘done’
to(ji)	‘beaten’
tha(ji)	‘to cut’
tho(ji)	‘to receive’

Four female speakers of Eastern Tamang took part in the recording session conducted in Kathmandu,

Nepal. All had no history of speech or hearing impairment. It should be noted that the participants speak Nepali as it is the official language in Nepal. However, all the speakers reported that the primary language they speak at home is Tamang. Table 1 summarizes the information of age and the home city that each speaker comes from.

Table 1: Demographic information of the speakers

	Age	Hometown
Speaker 1	18	Bhaktapur
Speaker 2	22	Dolkha
Speaker 3	23	Kavre
Speaker 4	25	Lalitpur

The target words were randomized and presented to the speakers using PowerPoint slides. Each slide was presented with a stimulus in the Nepali Devanagari script as well as in Roman alphabets. Participants were asked to identify words that are used in Tamang; only those words that were accepted by speakers were recorded. Five repetitions were made for each word in isolation and in a frame sentence. The current analysis focuses on the acoustic analysis of words in isolation and reports the results.

2.2. Analysis

Voice onset time (VOT) of the stops and f0 of the following vowels were measured using Praat. Time-normalized f0 contours of the vowels were created by averaging f0 values of 10 equally-timed windows within the vocalic intervals.

3. Results and discussion

Boxplots in Figure 1 presents VOT values of the stops depending on the stop categories: Aspirated (asp), voiced (vd), and voiceless (vl) categories. Overall, VOT values clearly separate the stops into three groups; long positive VOT for aspirated, short positive VOT for voiceless, and negative VOT for voiced stops. Except for some tokens of Speaker 2, the voiced stops always involve pre-voicing, which is contrary to the claim by Mazaudon (2014) or Varenkamp (to appear). Rather, our results seem to support the three categories of stop contrast argued by Yonjan (1993). Speaker 2 exhibits exceptionally large variations for aspirated and voiced categories. Perhaps the stop category of some words we recorded is actually different in the dialect that this particular participant speaks. However, this possibility is less likely since the five repetitions of the same word show a large variation in VOT. Alternatively, we can posit that some words beginning with an aspirated or a voiced stop undergoes a change-in-progress. More controlled data which are produced by speakers from the same area are required to confirm this alternative possibility.

A linear mixed-effects analysis was performed to compare the VOT values of stop contrast. We

entered into the model the speaker as random effects and the stop category as fixed effects. The confidence interval was set at 95%. The results revealed that the stop category has a significant effect on the VOT ($F(2,123)=207.1019$, $p<.001$*).

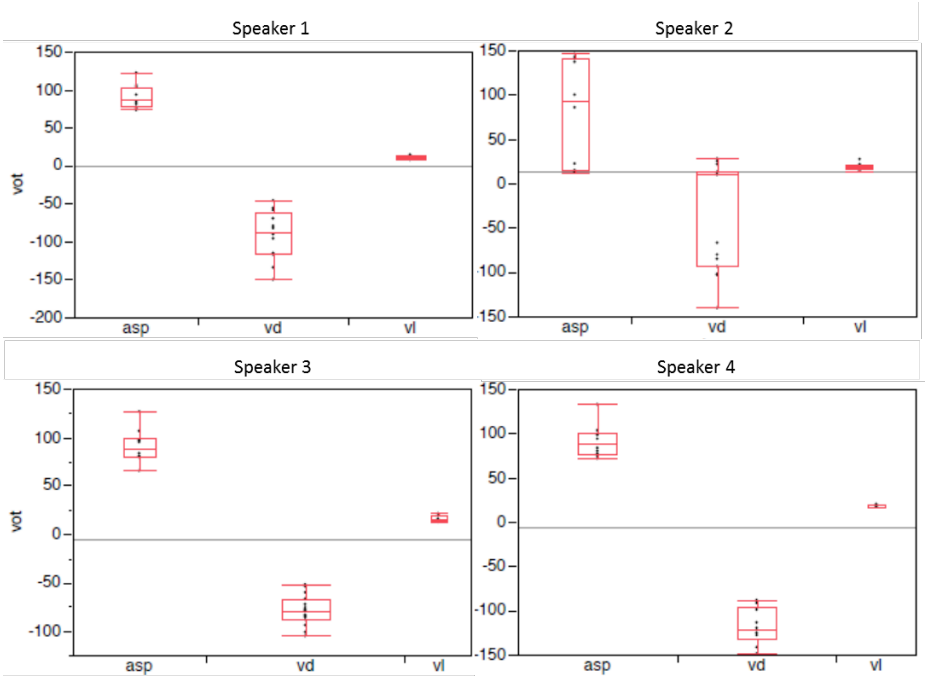

Figure 1: Stop VOT (ms) for each speaker. X-axis represents different stop categories

Turning to the f0 of the following vowels, f0 movements of the three categories do not exhibit appreciable differences. Figure 2 shows time-normalized f0 contours of the vowels for each speaker. Only the first 1 or 2 frames render noticeable differences where the voiced category is associated with lower f0 compared to the voiceless or aspirated category. It is not surprising that f0 following voiced obstruents typically produce lower f0 perturbation. Besides the vowel onsets, the contours seem to be extremely similar regardless of the stop category. Although Speaker 4 renders slightly higher f0 for voiceless stops, aspirated and voiced stops more or less pattern together, and the overall tonal shape of the voiceless category seems to be quite similar to the aspirated one. In order to test the statistical significance of this observation, a linear mixed-effects model was constructed with the speaker as random effects and the stop category as fixed effects. The results confirm that the stop category has no significant effect on the f0 ($F(2,123)=1.6843$, $p=0.19$).

The lack of difference in f0 among the stop categories suggests that the tonal distinction reported by Mazaudon (1973, 2014) may not be present, at least in the dialects we examined. It is worth reiterating that there is no phonologically contrastive voicing but it can be observed only in the two low tones (Tone 3 and Tone 4 in her terms). However, the results of the current acoustic study did not show supporting evidence for her analysis. The discrepancy between Mazaudon's description

and our results might be attributed to the recent loss of tones and the emergence of voicing perhaps due to sociolinguistic factors, such as the influence of Nepali or other non-tonal languages. The dominant language that the majority of Tamang speakers use in school or workplace is Nepali. Alternatively, dialectal differences might be responsible for the discrepancy. This issue needs to be investigated in more detail and with speakers living in the native Tamang area in future research.

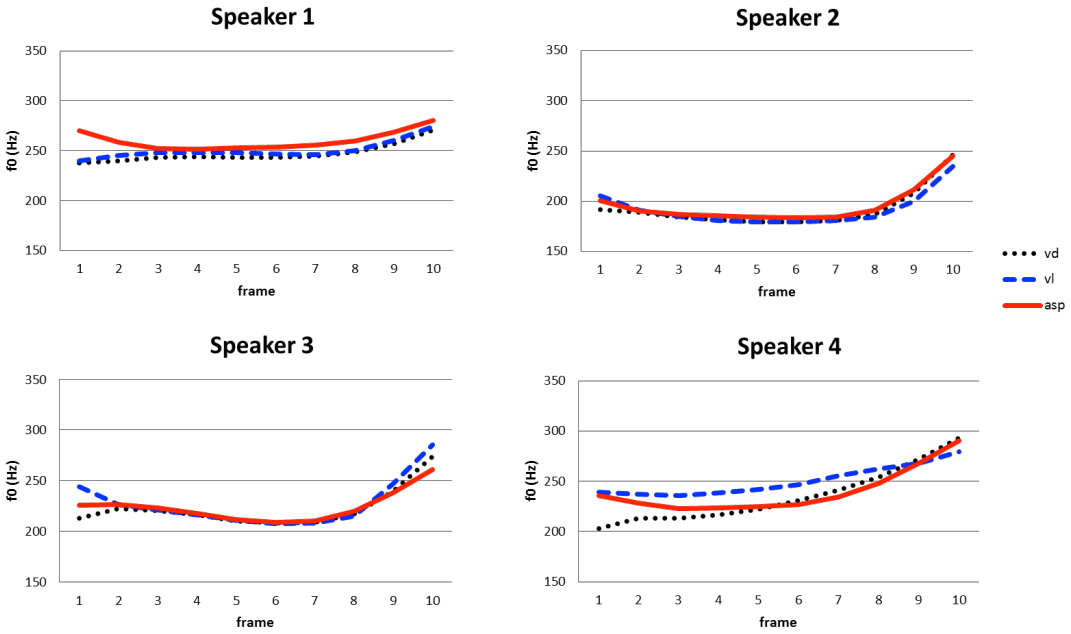

Figure 2: Time-normalized f0 contours of the following vowels for each speaker. Voiced (vd), voiceless (vl), and aspirated (asp) categories are represented by black dotted lines, blue dashed lines, and red solid lines, respectively.

4. Conclusions

The present findings provide instrumental and empirical data to understand the sound system of (Eastern) Tamang. Our results reveal that the laryngeal contrast in Tamang is best characterized as a contrast among fully voiced, non-aspirated voiceless and heavily aspirated stops. Further, there was no close correlation is fbetween tonal patterns and VOT. Altogether, the acoustic data in the current study corroborate Yonjan (1993)'s phonological system. Still, it is not clear if this is a dialectal difference or a tone loss, which will be left for future studies.

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