Language-internal behavior of typologically rare sounds:
Production, perception, and distribution of breathy sonorants in Marathi
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Breathy sonorants are cross-linguistically rare, occurring in just 1% of the languages indexed in the UCLA Phonological Segment Inventory Database (UPSID) and 0.2% of those in the PHOIBLE database. They are also quite understudied: prior work has shed some light on their acoustic properties, but much remains to be learned about the perception and language-internal distribution of these sounds. The current work focuses on breathy sonorants in Marathi, an Indic language which contains breathy nasals, approximants, laterals and rhotics (Dhongde & Wali 2009). Using instrumental acoustic analysis, a perception experiment, and corpus analysis, I show that breathy sonorants, in addition to being cross-linguistically rare, are also under-represented language-externally. Specifically, the acoustic differences associated with phonation type contrasts in sonorants are sensitive to contextual factors in a way that those associated with obstruents are not. Phonation type contrasts are prone to more perception errors in sonorants than in obstruents, and breathy sonorants are subject to more phonotactic restrictions than breathy obstruents. By considering these data together, I contribute to a more nuanced understanding of breathy sonorants in Marathi in particular and of typologically rare sounds in general.

The production experiment reported herein was conducted to determine whether the acoustic correlates of breathy voice in sonorants are in line with those reported for vowels and obstruents. Ten native speakers (five female) produced Marathi words featuring plain and breathy obstruents and sonorants in word-initial and word-medial positions before the vowels [a] and [e]. The results indicate that, as expected, breathy voice in both obstruents and sonorants is associated with decreased Cepstral Peak Prominence (CPP) and increased H1-H2* and H1-A3* values. Sonorants, however, show more contextual variation than obstruents: while phonation type contrasts in word-initial obstruents trigger significant CPP differences in subsequent vowels, those in sonorants do not. Further, while phonation contrasts in both obstruents and sonorants trigger significant H1-H2* differences in subsequent vowels for male speakers, for female speakers the differences are significant only after obstruents. Acoustic differences triggered by phonation type, in other words, are more reliably present in obstruent than in sonorant contexts, where they are sensitive to such factors as word position and vowel.

A perception experiment consisting of a series of identification tasks was conducted next, to determine whether phonation type contrasts in Marathi are perceived as accurately in sonorants as in obstruents by native listeners. CV syllables—dental consonants (/d/~dʱ/, /n/~nʱ/, /l/~lʱ/) paired with [a] and [e]—were excised from real Marathi words and presented in consonant-pair blocks (i.e. a D block featuring only the /d/~dʱ/ contrast). Blocks were randomized, and listeners were asked to identify the consonant they heard by clicking on the appropriate Devanagari character. Preliminary data from seven subjects reveals that perception of phonation type is more accurate ($p < .001$) for obstruents (92%) than for sonorants (82%).

In order to investigate the distribution of breathy consonants in the Marathi lexicon, the final experiment investigated phonotactic frequencies in the 2.2 million-word Marathi portion of the EMILLE/CIIL corpus. This is a written corpus: while no spoken corpus of Marathi of comparable size is currently available, analysis of a written corpus as a first step towards identifying the general phonotactic patterns in the language is suitable given that the Marathi orthography (Devanagari) is transparent. Token frequency of consonants (the sheer number of
times the phone of interest appears) and type frequency of bigrams (the number of words that contain the targeted bigram) are reported. The most basic finding, shown in the mosaic plot in Figure (1), is that breathy sounds are underrepresented in general: 8% of the consonants in the corpus are breathy, but most of these are obstruents. Just 0.63% of the consonants in the corpus are breathy sonorants. Furthermore, as illustrated in Figure (2), breathy sonorants do not co-occur with all monophthongs evenly. Rather, they co-occur with [a] more than 60% of the time, while co-occurrence with back rounded [o] and [u] is heavily restricted.

Considering this language-internal pattern of underrepresentation and uneven distribution in tandem with the acoustic and perceptual findings yields the following observations:

1. The acoustic correlates of phonation type contrasts in sonorants are more context-dependent than similar contrasts in obstruents.
2. Perception of phonation type contrasts is more accurate for obstruents than for sonorants.
3. Breathy sonorants are underrepresented overall in the Marathi lexicon, and co-occur particularly rarely with certain vowels.

While similar investigation of the acoustic, perceptual, and distributional patterning of breathy sonorants in other languages will shed additional light on the typology of these sounds, the Marathi data suggest that phonation type contrasts in sonorants are poorly cued and underrepresented even in a language which does contain them. These sounds may be rare because they do not make for strong contrasts.

References: