

Tonogenesis in Khmer: A cross-dialect comparison

Introduction Unlike many languages of Southeast Asia, Khmer (Cambodian) is not a tone language. However, a pitch-based contrast between certain words in a number of Khmer dialects has been noted since at least the 1960s (e.g. [3]). While the emergence of lexical tone is common in languages of Southeast Asia, the manner by which it might be taking place in Khmer – as a result of loss of /r/ in initial clusters – has not been reported for any other language [5]. Here, we compare acoustic and perceptual data on the emergence of f0-based contrast in two varieties of Khmer: the colloquial speech of the capital Phnom Penh (PP), and the dialect spoken in Giồng Riềng district, Kiên Giang province, Vietnam (KG). In addition to providing new empirical data on an understudied precursor, we illustrate the methodology of analyzing perceptual response data using generalized linear mixed models [1].

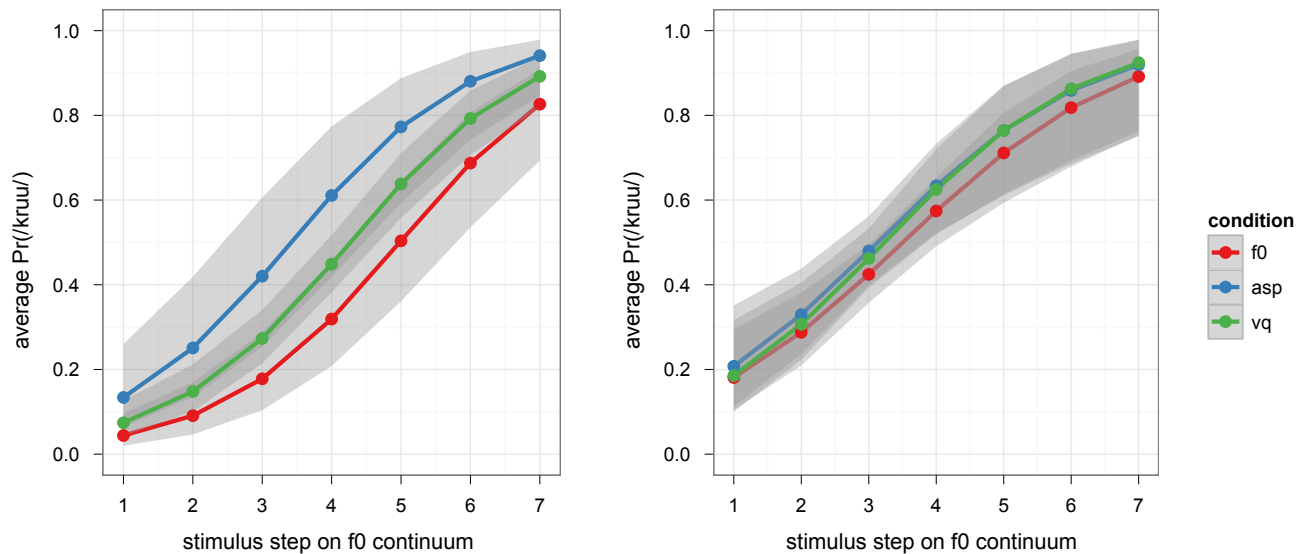
Background In Standard Khmer, one can find minimal triplets such as /ku:/ ‘pair’, /k^hu:/ ‘old’ and /kru:/ ‘teacher’. In PP and KG, /r/ > ∅ in /Cr/ onset clusters, with several sources [3, 4, 5] reporting the contrast is maintained by other acoustic cues such as aspiration, a falling-rising pitch contour, and breathy voice quality, e.g. /kru:/ > [k^hũ:, k^hũ̃:]. However, the only acoustic description of this phenomenon [5] is preliminary, and it is not clear which, if any, of these cues have become perceptually sufficient or salient for listeners.

Methods Production and perception data were gathered from 40 native Khmer speakers (20 PP, 20 KG). In the production task, subjects read a wordlist of /CV(C), C^hV(C), CrV(C)/ triplets covering a range of vowel qualities in both careful and colloquial conditions. Subjects also participated in a 2AFC listening experiment. A 7-step [ku: ~ kũ:] continuum varying drop in f0 midpoint was used as the basis for two additional continua by adding a fixed degree of aspiration [k^hu: ~ k^hũ:] or breathy voice [kũ: ~ kũ̃:]. This design allowed the potentially additive effect of several acoustic cues to be explored with a minimum number of trials.

Results Acoustic analysis of the PP data show colloquial productions of forms like /kru:/ are characterized by loss of /r/, a falling-rising f0 contour, increased post-release aspiration, and a fall-off in higher spectral energies relative to reading productions. KG forms similarly developed an f0 contour, but no aspiration or breathiness. These differences are also reflected the perceptual findings (Fig. 1). Mixed-effect logistic regression models fit to PP perceptual response data show the probability of a /kru:/ response depends significantly on the degree of F0 drop, and is increased by the addition of aspiration or breathiness ($p < 0.001$ in both cases); in KG, f0 was similarly a significant response predictor, but there was no additive effect of either other cue. These results suggest that f0 has become a necessary and sufficient cue to this contrast in both PP and KG.

Crucially, careful productions forms like /kru:/ are found to contain excrescent vowels in both dialects, *contra* [2]. I suggest that the f0 contour finds its source in the higher pitch associated with the excrescent vowel, combined with the lower pitch on the vocalic nucleus conditioned by devoicing and fricativization of /r/. That no degree of post-release aspiration or breathy voice quality is observed in the KG forms suggests that this sound change may be more advanced relative to PP, perhaps due to bilingualism/contact with tonal Vietnamese.

FIGURE 1. 2AFC perceptual responses for PP (left) and KG (right) listeners. f0 = baseline 7-step f0 condition; asp = addition of fixed 70ms aspiration; vq = addition of breathy voice quality.



REFERENCES

- [1] A. Agresti. *Categorical data analysis*. John Wiley & Sons, New York, second edition, 2002.
- [2] F. E. Huffman. The boundary between the monosyllable and the disyllable in Cambodian. *Lingua*, 29: 54–66, 1972.
- [3] R. B. Noss. The treatment of */r/ in two modern Khmer dialects. In N. H. Zide, editor, *Studies in Comparative Austroasiatic Linguistics*, pages 89–95. Mouton & Co., London, 1966.
- [4] Thạch Ngọc Minh. Monosyllabization in Kiengiang Khmer. *Mon-Khmer Studies*, 29:81–95, 1999.
- [5] R. P. Wayland and S. G. Guion. Sound changes following the loss of /r/ in Khmer: A new tonogenetic mechanism? *Mon-Khmer Studies*, 35:55–82, 2005.