Contour Tone Distribution in Luganda *Keywords: phonology, phonetics, tone*

In this paper, we present new data from Luganda that provide insight into the decision between a phonological vs. a phonetic model of contour tone distribution. As we show, the phonological and phonetic facts of Luganda converge on a particular phonological analysis of the distribution, and these facts cannot be satisfactorily explained under a purely phonetic model.

The traditional model of contour tone distribution (see Hyman 2003 for a summary) has used phonological constructs such as syllables and moras to predict which syllable types can bear rising or falling tones. In this model, inter-language variation in contour tone distribution reduces to representational differences; for example, the tone-bearing unit (TBU) may be the mora or the syllable, and the language may rule out structures where a TBU bears more than two tones, or more than one tone. Certain tone sequences associated with a single syllable (e.g., L(ow)-H(igh) rising tones) may be ruled out in some languages but permitted in others. Within these parameters, the phonological model should be able to account for all of the patterns of contour tone distribution found in the world's languages.

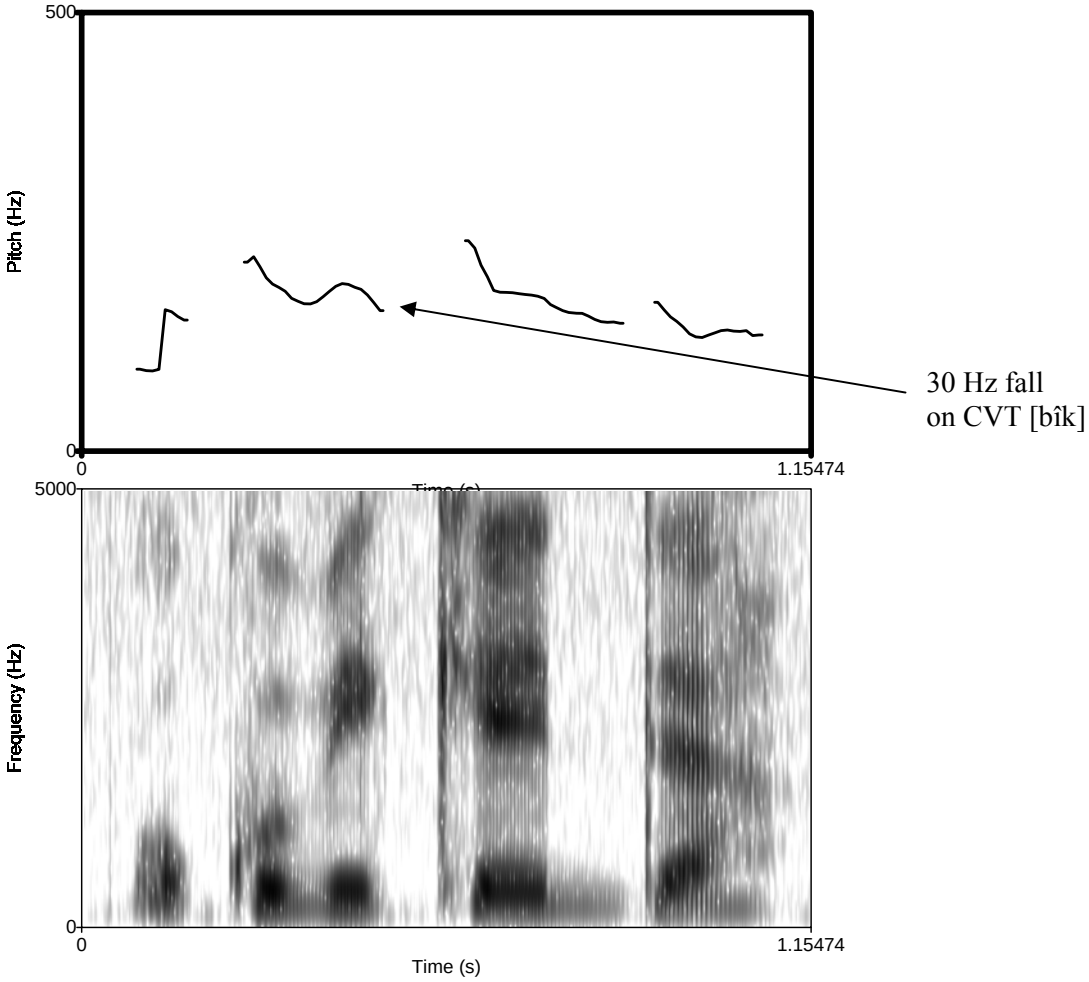
As an alternative to the phonological model, Gordon (2001) and Zhang (2001) have proposed that the distribution of contour tones is a surface-based, phonetic phenomenon based on a syllable's 'sonorous rime duration' (SRD; this is the duration of the syllable nucleus plus any sonorant consonant(s) in the coda). In this approach, if contour tones can occur on a syllable type with an SRD of *x* milliseconds, then they must also be permitted on all syllable types with an SRD greater than *x* milliseconds. For most languages, depending on the relative SRD of CV and CVO, this yields the following implicational hierarchy for suitability to bear a contour tone (where R = sonorant consonant, and O = obstruent consonant): **CVV > CVR > CV, CVO**. The phonetic model of contour tone distribution is therefore falsifiable by the discovery of a language that (in the same environment) permits contours on a syllable type with SRD *x*, but not on some syllable type with an SRD greater than or equal to *x*.

Zhang (2001: 74 *et seq.*) acknowledges some languages that seem on the surface to violate the implicational hierarchy, but argues in each case that the apparent counterexample is spurious. One of these languages is Luganda. Phonologically, the tones of Luganda are H, L, and HL (falling) (Hyman 2003). H and L occur on all syllable types, but (non-finally) HL can occur only on CVV, CVR, and CVO syllables. Hence, Luganda seems to violate the implicational hierarchy, since if CVO can bear a falling tone then CV should as well. Zhang explains this problematic example by claiming, based on a very small pilot study, that HL is not *phonetically* realized on CVO as a falling tone, but rather as level H with lowering of a following H (i.e., the L is displaced and realized as a downstep on the following syllable).

In our study based on a much larger sample set, we find strong evidence that, contrary to Zhang, CVO syllables *do* realize falling tones. We have found many examples of phonological pre-H falling tones (i.e., **HL**+H that contrasts with **H**+H, yielding near-minimal pairs) on both CVD and CVT syllables (D = voiced obstruent; T = voiceless obstruent) but none on CV syllables. So even if CVO did not realize phonetically measurable falling tones, the phonological distributional facts would be inexplicable under Zhang's model. But in fact, in our data, falling tones *are* realized phonetically on CVO as HL, not as H plus downstep. In the representative example in (1), a CVT syllable realizes HL as a 30 Hz pitch drop, which is comparable to representative examples of falling tones on, e.g., CVV syllables in our data. Therefore, both the phonological and phonetic data are problematic for the phonetic, SRD-based account.

The only apparent "out" for the phonetic account would be if CVO syllables turned out to have a significantly longer SRD than CV syllables in Luganda, contrary to the cross-linguistic trend. We do find some evidence that could be interpreted this way at first (2). But unfortunately for the phonetic model, only CVD syllables have a statistically significantly longer SRD (3). As seen in (4), CVT syllables have the same mean SRD as CV syllables do (in fact, CVT syllables are longer, but the difference is not statistically significant). So Luganda syllables are ordered by SRD as follows (from longest to shortest): **CVV > CVR > CVD > CV, CVT** (note: the data in (2-4) represent only penultimate H-toned [i], but so far our data on other vowels and positions are consistent with these results). Therefore SRD alone cannot account for contour tone distribution. The one generalization that does account for the distribution is phonological. As shown in (5), if codas are moraic in Luganda, then the phonological generalization **"One tone per mora"** is sufficient to account for why CVT syllables pattern with CVV, CVR, and CVD to the exclusion of CV in allowing falling tones, regardless of their relative phonetic duration.

(1) Falling tone on CVT [òkú**<u>bîk</u>**kéddà] ‘to cover later’



ò k ú **<u>b î k</u>** k é d d à

(2) SRD of H-toned [i] in penult

	CVO	**CV**
mean	85.5 msec	66.6 msec
stdev	18.5	10.9

CVO > CV (t=2.27, p=.039)

(3) SRD of H-toned [i] in penult

	CVD	**CV**
mean	96.1 msec	66.6 msec
stdev	8.65	10.9

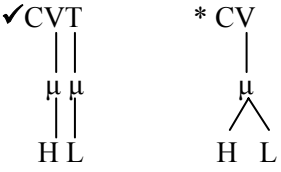
CVD > CV (t=5.45, p < .001)

(4) SRD of H-toned [i] in penult

	CVT	**CV**
mean	61.0 msec	66.6 msec
stdev	4.79	10.9

CV > CVT, not significant (t=0.819, p=.440)

(5)



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