Cue-Weighting in the Perception of Prosodic Boundaries in Chinese and English

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Prosodic phrasing plays a very important role in language comprehension and processing. It divides the speech into meaningful chunks of information. While most linguists accept that prosodic boundaries are marked by a variety of acoustic cues that involve pitch change, pauses, and pre-boundary lengthening (Cooper et al., 1978; Crystal & House, 1988; Klatt, 1975; Lehiste, 1973; Scott, 1982; Streeter, 1978), there is no consensus, however, on the relative importance of these cues in perception. Moreover, it is not clear precisely whether boundaries are perceived differently in different languages. The present study intends to investigate whether the perceptual weighting of the prosodic cues contributing to the marking of prosodic boundaries differ across languages (English and Chinese).

In the perception study, the stimuli were manipulated versions of the naturally produced sentence pairs that were constructed using the same words, but with different meanings depending on the presence of the prosodic boundaries as shown in (1) on page 2.

Two series of stimuli from each language were created: the first series starts with the original no-boundary reading (indicating no-boundary pitch pattern), with gradually lengthened pause duration and pre-boundary syllable; the second series starts with the original with-boundary reading, with gradually shortened pause duration and pre-boundary syllable. Based on the results of the production experiment, a continuum of silent pause was created from 0-80ms in 5 uneven steps: 0, 10, 20, 40, 80. A 5-step pre-boundary rhyme duration continuum was also generated from 80--180ms in a 25 ms increment. All the manipulation was implemented using Praat's PSOLA algorithm. In order to take the potential influence of post-boundary lengthening and pitch change into consideration, post-boundary elements were also switched between boundary and no-boundary sentences. Altogether, this resulted in 100 (5 duration x 5 pre-boundary x 2 F0 x 2 contexts) stimuli for each language.

Twenty native speakers from each language participated in the study. The perception experiment was a forced choice identification task, run on a Mac via Superlab software 4.5. In the experiments, the stimuli were auditorily presented to participants over headphones in 5 repetitions. Participants were instructed to decide whether the sentence they heard contained two or three items. They made judgment by pressing one of the labeled buttons (“2” or “3”) on a response pad.

The results of the experiments (see figure 1-4 on p.2) show that in Chinese, the effect of pitch appeared to offset the effect of pause and pre-boundary lengthening, with them showing different patterns under different pitch conditions. For English, the effect of duration and pre-boundary lengthening appeared similar under the two pitch conditions, with longer pause and longer pre-boundary rhyme causing more boundary classification. The mixed-effects logistic regression analyses further revealed that in both languages, pitch, pause duration, and pre-boundary lengthening were significant predictors of the identification of prosodic boundaries. However, Chinese listeners weighed pitch change much heavier than English listeners (as illustrated by the regression coefficients). Such differences in perceptual saliency suggest that language experience modulates the listener’s attention to cues that are particularly relevant in the native language.
(1) English  
a. turkey-salad and coffee  
b. turkey, salad, and coffee  

Chinese  
a. mogu-shala he hongjiu  ‘mashroom-salad and red wine’  
b. mogu, shala, he hongjiu  ‘mashroom, salad, and red wine’  

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**Figure 1.** Classification of prosodic boundary by pause\*rhyme with no-boundary pitch condition in Chinese

**Figure 2.** Classification of prosodic boundary by pause\*rhyme with boundary pitch condition in Chinese

**Figure 3.** Classification of prosodic boundary by pause\*rhyme with no-boundary pitch condition in English

**Figure 4.** Classification of prosodic boundary by pause\*rhyme with boundary pitch condition in English