Tone chain shifts in Thai and Lalo

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Why chain shifts occur is a question of long-standing debate: functionalist accounts (e.g. Martinet 1952) posit a pressure to preserve phonological and/or lexical contrasts, while others (e.g. Labov 1994, Blevins 2004) argue that low-level mechanical processes are sufficient. In this paper, we address this issue in the context of *tonal* chain shifts in Thai (Kra-Dai) and Lalo (Tibeto-Burman), two unrelated languages that show several parallel developments. We show how these chain shifts can be accounted for in a non-teleological way by the interaction of two phonetic biases: perceptual salience of dynamic contours and articulatory delay of tone targets.

In the Thai and Lalo chain shifts, summarized in Table 1, a two-stage process is observed for each tone: 1) F0 onsets of non-low rising tones lower, and onsets of non-high falling tones raise; 2) targets located at tone range extrema of high or low slide to the right, changing the contour shape. In the mid 19th century, Thai Tone 2 (aka "Low") and Tone 5 (aka "Rising") both had a rising component (Pittayaporn 2018b). Tone 2 lowered and its rise elided by the early 20th century; subsequently, Tone 5 lowered and its low target slid to syllable midpoint, resulting in a falling-rising contour. Conversely, the onset of Tone 3 ("Falling") became gradually higher through the 20th century; then the alignment of the high target slid rightward, rendering a rising-falling contour. Lalo's chain shift, reconstructed via lect comparison (Yang 2015), follows a similar path to Thai. Lalo T1 in syllables with historically voiced initials gradually changed from high level > mid rising > low rising, reminiscent of Thai Tone 5. Lalo's TLow, similar to Thai Tone 3, changed from low falling > mid falling > high falling > high rising-falling > high rising.

Table 1. Tone chain shift in Thai over two centuries (Pittayaporn 2018a, 2018b) and in Lalo across lects (Yang 2015)

THAI:	**MID 19TH C**	**EARLY 20TH C**	**MID 20TH C**	**EARLY 21ST C**
TONE 2	mid falling-rising	low level/falling	low falling	mid falling
TONE 5	mid rising	mid rising	low rising	low falling-rising
TONE 3	mid falling	mid falling	high falling	high rising-falling

LALO:	conservative lects ---------->			innovative lects	
T1 *+VOI	high level	mid rising	low rising		
TLOW	low falling	mid falling	high falling	high rising-falling	high rising

We argue that these changes can be accounted for by two phonetic biases: perceptual salience and tone target delay. Speech with dynamic pitch cues is consistently better perceived than monotone speech, and dynamic pitch excursions aid speech recognition in noise (Shen & Souza, 2018). By hypothesis, this may lead to a selectional bias in which an allotone with an enhanced F0 excursion is more likely to be selected as the new canonical tone value (Pittayaporn 2018a). As a result, onsets of non-low rising tones lower, and onsets non-high falling tones raise. Target delay describes the speed differential between laryngeal (slow) and supra-laryngeal (fast) articulators (Hyman & Schuh 1974, Pittayaporn 2018a). Tone targets, especially if located at tone range extrema, tend to be delayed in connected speech, which may lead to a later alignment. These same biases are implicated in cross-linguistic tone change trends, regardless of whether the changes occurred as part of a tone chain shift (Yang & Xu 2019). We conclude that the observed tone chain shifts can be explained as the interaction of these two biases over time.

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