

### Tone neutralization in Mandarin T3 sandhi: A perceptual account

It is not a new idea that listeners may shape phonology (Ohala 1981, Hume & Johnson 2001), and evidence has been found that phonological alternations may be the result of merging a contrast of low perceptibility (see Hume & Johnson 2001). In the area of lexical tones, the most studied case of phonological neutralization is Mandarin T3 sandhi, which targets a sequence of two low dipping tones (T3s) by changing the first T3 into a rising tone (T2). Up until now, this process has received neither a satisfactory phonological interpretation nor an articulatory motivation (see Chen 2000, Zhang 2007), while a perceptual account is completely missing. To fill this void, the current study aims at shedding light on the possible universal perceptual biases that may have shaped the T3 sandhi. We asked why T3 sandhi occurs in such an asymmetrical and positional way, in which the first T3 is neutralized while the second T3 stays in intact,

We hypothesize a perceptual motivation for T3 sandhi, namely that T3 sandhi targets at the contrast with low perceptibility; the surfaced sandhi form, the T2T3 is the perceptually most similar sequence to the underlying T3T3. This hypothesis was tested with a perception experiment in which 48 native Mandarin listeners and 48 native Dutch listeners participated. Dutch listeners are naïve to lexical tones, whose responses mainly reflect natural perception without influence from language experience, while Mandarin listeners possess relevant language experience. The participants completed two discrimination tasks with disyllabic and monosyllabic tones, respectively. In both tasks, the stimuli within a trial were either T2 and T3, tones involved in T3 sandhi, or high level T1 and high falling T4, which fail to undergo sandhi, serving as controls. In the monosyllabic task, the contrasts to be discriminated were T1-T4 and T2-T3. In the bisyllabic discrimination task, the stimuli were pairs composed of T3T3-T2T3, T3T3-T3T2, T4T4-T1T1, T4T4-T4T1, or T4T4-T1T4. Each to-be-discriminated pair occurred in both orders (such as T3T3-T2T3 and T2T3-T3T3) with equal chance.

It was found that in the disyllabic tonal sequence discrimination task, both Dutch listeners and Mandarin listeners were more accurate in discriminating T3T2-T3T3 than T2T3-T3T3. Pairs consisting of sequences of identical tones T2T2 and T3T3 were highly discriminable. Moreover, both groups reached higher accuracy if T3T3 occurred first in the to-be-discriminated pair. In the monosyllabic tone discrimination task, both groups discriminated T2 and T3 more accurately in a T3-T2 order than in a T2-T3 order. On the contrary, no such confusion asymmetries were found for the T1-T4 contrast in either task for either group. Both groups displayed higher accuracy in discriminating T1-T4 than T2-T3 in both tasks. Nevertheless, due to the experience with T3 sandhi, native Mandarin listeners demonstrated much stronger confusion asymmetries than their Dutch counterparts. Hence, we argue that T3 sandhi may be perceptually motivated: it targets a contrast with low perceptibility, and neutralizes T2T3 and T3T3 as these sequences are perceptually most similar. The phonologization of such biases, T3 sandhi, strengthens innate discrimination asymmetries among native Mandarin listeners.

### References

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