

Pitch Target of Mandarin Neutral Tone

While it is unanimously agreed that there are four distinctive lexical tones in Beijing Mandarin (high level, high rising, low falling-rising, and high falling), there exist a number of items described by the cover term neutral tone (Chao, 1968), the tonal status of which has aroused much interest and debate. Typical examples include grammatical morphemes (e.g. the genitive/norminalizer marker *de* in 1a), lexical items (*li* in 1b), diminutive terms (*mei* in 1c), and reduplication (the second *xiang* in 1d). (Syllables without tonal marking indicate neutral tone.)

What these syllables have in common is that they do not surface with any of the lexical tones. Instead, their f₀ contours seem to vary depending on the tone of the preceding syllable. The received wisdom is that these syllables are toneless. Traditionally, much controversy surrounds the theoretical account of the f₀ realization of neutral tone. The fundamental question pits one school against the other: Is neutral tone realized by tonal spreading from the preceding syllable (Yip 1980) or by interpolation between the immediately preceding and following tones (Shih 1987)?

This study was designed to investigate the detailed f₀ realization of sentence medial neutral tone to seek phonetic evidence for the construction of an appropriate phonological theory. The test material consists of 32 sentences which vary in 1) the number of consecutive neutral-tone syllables (ranging from one to three); 2) the tone of the syllable preceding the neutral-tone syllables (all four lexical tones); and 3) the tone of the syllable following the neutral-tone syllables (two lexical tones, one starting high and the other low). Four subjects were recorded, each producing 6 repetitions (three at normal and three at fast speaking rates).

Our data show that the f₀ contour of a neutral tone syllable does exhibit an influence from its preceding lexical tone. When there is only one neutral tone syllable, the magnitude of the influence is substantial. As the number of neutral-tone syllables increases, however, the f₀ contour of the neutral tone approaches a particular value, which, by the end of a string of 3 consecutive neutral tone syllables, approximates the lower mid range of our speakers' pitch range. This is especially clear when the string of neutral tones follows a rising tone and precedes a falling tone (see figure 1). With only one neutral tone syllable in between, we see that between the two high peaks of the rising and falling tones, there is only a slight dip of f₀ over the second half of the neutral tone syllable (i.e., with an f₀ peak occurring after the mid point of the neutral tone syllable). As the number of neutral-tone syllables increases, the f₀ value of the following neutral tone gradually lowers, until it approximates that particular value, which is lower than the peaks of both the preceding rising tone and the following falling tone. As a result, the f₀ contour of the falling tone syllable starts at a relatively low value and rises to its highest point before it starts to fall. This pattern is similar to the f₀ pattern when a lexical falling tone follows a lexical low tone.

It is apparent that such a declining slope of f₀ pattern can not be explained by either tonal spreading or tonal interpolation, both of which would predict an f₀ contour that remains high after the rising tone and stays high to connect to the following falling tone. We argue that the observed f₀ patterns can be better explained by assuming that neutral tone has a target of its own. This target, however, seems to differ from those of the other four lexical tones in two ways. First, it has a pitch value that is relatively centralized. Second, its articulatory implementation is different from that of the other lexical tones in that it allows tonal co-articulation with much robust influence from the preceding syllable. Thus the target value itself and the manner at which it is implemented are jointly responsible for the f₀ contour of the neutral tone.

Results of our data will also be compared with data from recent studies on English intonation (Ladd & Shepman 2003), in light of which, we will discuss the f₀ realization of tonal targets in both tone and intonation languages. Work on computational modelling of the systematic variability in tonal production will also be presented to lend further support to the proposal.

(1)

- a. làde ‘something spicy’
- b. bōli ‘glass’
- c. mèimei ‘sister (diminutive)’
- d. xiángxiang ‘to think (for a little while)’

(2)

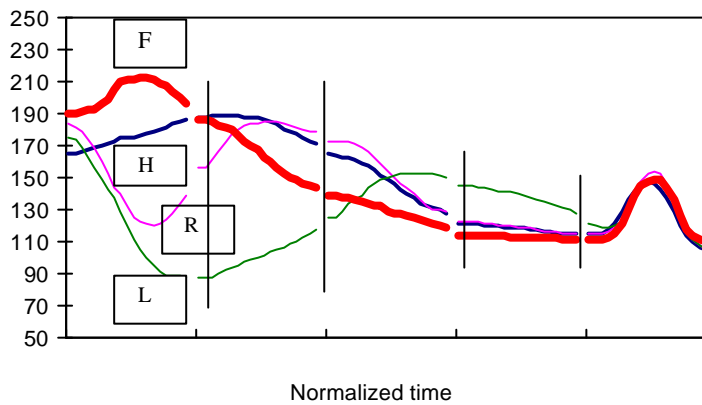


Figure 1. Normalized F_0 contours of a string of three consecutive neutral tones preceded by four different lexical tones and followed by a falling tone. (Note: syllable boundaries are indicated with vertical line)