

Pitch accent alignment in Persian

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The study was intended to examine the effects of various prosodic factors such as syllable structure and segmental composition as well as proximity of the following word boundary and accent on scaling and alignment pattern of prenuclear rising accents in Persian, in order to shed some light on our understanding of the production of the accent gestures and their coordination with the segmental material. Two production experiments were conducted.

The first experiment explored the variability in the timing of the tonal targets as a function of syllable structure and vowel type of the target accented syllable. Results revealed that in proparoxytones, the alignment of the H tones was affected by variations in the duration of the accented syllable in consistent ways: H pre-nuclear peaks were earlier in open and short syllables than closed and long syllables (see Fig. 1 (left panel) for a comparison between open and long syllables). However, when the alignment of the H was measured with reference to the onset of the first post-accentual vowel, syllable structure or vowel type failed to produce significant effects: The H target was aligned on average within 10 ms after the onset of the first post-accentual vowel syllables (see Fig. 1 (right panel) for a comparison between open and long syllables). The results support the Segmental Anchoring Hypothesis, whereby the duration of pitch movements in speech is finely adjusted to the duration of the accompanying segmental material.

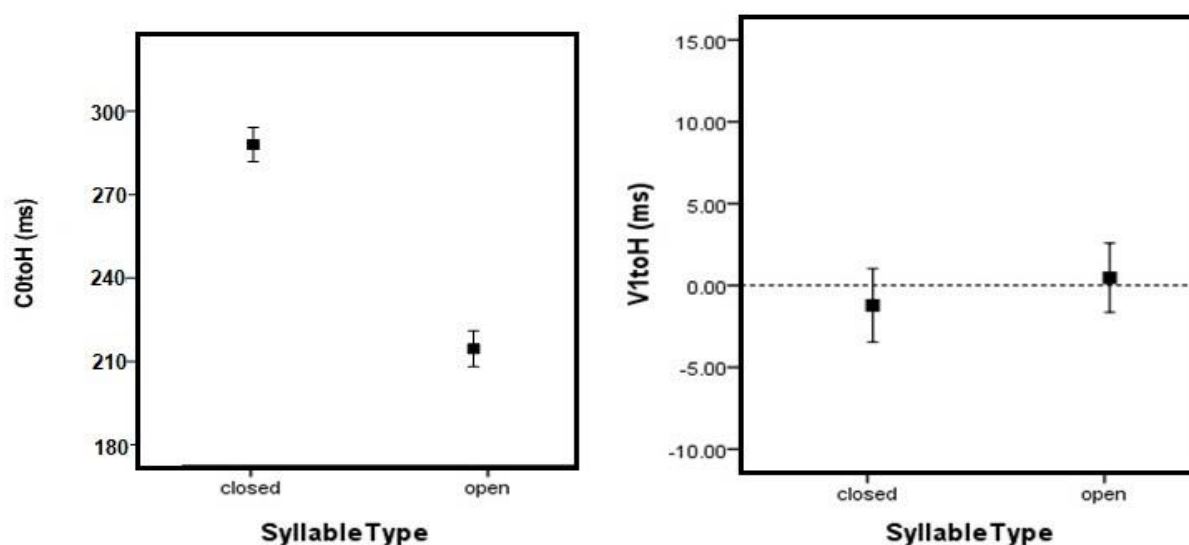


Fig. 1 Left panel: Mean distance from the beginning of the consonant of the accented syllable to H (C0toH); Right panel: Mean distance from the onset of the accented vowel to H (V1toH) (right) as a function of syllable structure.

The second experiment examined the variability in the scaling and timing of pitch accents as a function of the proximity of the word boundary and of the following accent. The alignment data revealed clear effects of stress conditions on H location. Peaks were located earlier as the distance of the target accented syllable and the word boundary decreased. The H target was realized early in oxytones, and progressively later in paroxytones and proparoxytones. L targets, on the other hand, were highly stable across different stress conditions.

In general, our results replicate and extend earlier findings of Arvaniti et al [2] for Greek, Ladd et al., [4] for English and Atterer and Ladd [3] for German showing that in the absence of prosodic pressure from the upcoming material, i.e., when the accented syllable is not in the vicinity of the word boundary or the next accent, the two tones of pre-nuclear pitch accents in Persian are

consistently aligned with respect to the segmental material, and the stability effects are pervasive under changes of segmental or syllable structure composition.

A cross-linguistic comparison between the Persian data and data from other languages reveals subtle differences in alignment (as shown in Fig. 13) that cannot be accounted for in terms of phonological specifications of tonal association; rather they might best be interpreted in terms of continuous phonetic alignment rules as proposed by Atterer and Ladd [3], and also advocated by many others, including Arvaniti [1]. Phonetically the pattern of L alignment we find for Persian is slightly later than those of English [4] and Greek [2] and rather earlier than Southern German [3]. For H, the Persian pattern of alignment is quite comparable to what Arvaniti et al. [2] found for Greek and what Atterer and Ladd [3] found for Northern German, and rather later than the findings of Ladd et al. for English and Dutch. One interpretation of this comparison would be that language-specific differences in the alignment of pitch movements may be a matter of what Ladd [5] calls phasing: the same F0 change can be aligned earlier or later. This in turn suggests that the two targets of a bitonal pitch movement are not independently aligned at specific places in structure; rather the whole movements are aligned relative to whole syllables. Thus, Southern German aligns both L and H later than Northern German, Greek and Persian, which in turn align both L and H later than later than Dutch and English. This, in general, may provide some evidence for Xu's idea [7] that the rise is, at some level of analysis, a unitary phonological event, the alignment of which is specified as a whole.

In general, our findings of segmental anchoring provide little evidence for the starred tone interpretation assumed in early auto-segmental theory, according to which one of the two tones of a bitonal accent must be aligned with the accented syllable, while the other tone merely leads (or trails) the starred tone by a fixed temporal interval. In addition, starring one of the two tones in the Persian LH pitch accents would pose problems for Persian intonational system in which there is no contrast of alignment between L+H* and L*+H [6]. Rather, based on both language-specific and cross-linguistic evidence presented in this study, we may suggest that the most appropriate representation of pre-nuclear rising accent in Persian is the starless sequence of a low (L) and a high (H) tone, namely LH, where the L is realized at the beginning of the stressed syllable and the H early in the vowel of the post-tonic syllable according to phonetic implementation rules of alignment for Persian.

References:

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