

Is Persian a "stress-accent" or a "non-stress-accent" language?

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1- Introduction

Jun (2005) classifies Persian with English, German, Dutch, Greek, Italian, Spanish, Portuguese, Lebanese Arabic, and Bininj Gun-wok (a Northern Australian language) as 'stress-accent' languages. However, recent studies on the phonetic correlates of stress in Persian have shown that pitch is the only reliable acoustic parameter to cue stress in Persian, suggesting that Persian is a 'non-stress accent' language. In a production study, Abolhasanizadeh, Bijankhan and Gussenhoven (2012) examined the phonetic correlates of the prominence contrast in Persian, and found that prominent syllables are not systematically differentiated by durational or spectral properties from non-prominent syllables, leading them to conclude that word-level prominence in Persian is 'non-stress accent' in the sense of Beckman (1986), i.e., prominence is not the result of lexical stress, but post-lexical tonal marking (pitch accent). Similarly, in a more recent study, Rahmani, Rietveld and Gussenhoven (2015) performed a perception experiment in which they measured listeners' sensitivity to prominence contrasts (using a Sequence Recall Task) in subjects with different language backgrounds including Persian, and found that while speakers of Dutch and Japanese are sensitive to stress information in speech, speakers of Persian, like those of French, show little sensitivity to word prosodic contrasts. They argued that listeners' sensitivity to stress cues depends on the function of stress in their native language: Persian and French are languages without lexical stress or tone markings (in which prominence is marked in post-lexical constructions through the presence of a pitch accent), and as such, listeners develop little sensitivity to stress cues. By contrast, Dutch and Japanese possess lexically contrastive prosodic features and thus require that listeners develop sensitivity to stress contrasts.

No specific experimental study, however, has systematically investigated the acoustical properties that signal word-level prominence contrast in Persian in accented and unaccented positions. In a production experiment, duration and intensity measures were examined as the acoustic correlates of word prominence in a corpus of Persian materials that varied lexical stress independently of accentual prominence. The questions specifically asked in this experiment are: A) Can intensity and duration reliably differentiate accented syllables from unaccented syllables in Persian? B) Are measures of intensity and duration reliable acoustic correlates of lexical stress in Persian when words are produced in unaccented condition (in the absence of F0 information)?

2- Materials and acoustic measurements

A corpus of 960 utterances was designed to exhibit the phonological variety needed to examine the acoustic correlates of the stress contrast in Persian. The test materials included 6 Persian minimal or near-minimal stress pairs with a CV(C).CV(C) structure (Table 1).

Table 1: Target minimal or near-minimal stress pairs representing each of the six vowels of the Persian language.

vowels	stress pairs	
	noun/adjective	noun/adjective plus clitic combination
i	[mi'ni] (adjective: 'small')	['mini] (noun: 'a mine')
e	[ge'le] (noun: 'complaint')	['gele] (noun (genitive): 'mud of')
a	[læn'dæn] (noun: 'London')	['længæm] (adjective: 'my defective')
u	dʒu'nun] (noun: 'madness')	['mumun] (noun (possessive): 'our hair')
o	[ro'mo] (noun: 'Romo')	['romo] (noun (object): 'Romo')
ɑ	[na'na] (nonsense)	['nana] (nonsense)

A Praat (Boersma and Weenink, 2005) script was used to extract all acoustic measurements for the data analysis, including F0 excursion (F0 excursion was used as a control variable in order to insure

that lexical stress is cued by a pitch accent only in the accented utterances and not in the unaccented utterances), duration, vowel quality (in terms of the first two formant frequencies) and intensity.

3- Results and Discussion

The results for duration showed that syllable duration in Persian is sensitive to the stress condition of the target syllable independently of pitch accents. Similar findings have been reported for many ‘stress accent’ languages like English (Huss, 1978; Okobi, 2006), Dutch (Suijter and van Heuven, 1996), Spanish (Ortega-Llebaria and Prieto, 2007), Catalan (Ortega-Llebaria and Prieto, 2010).

Unlike duration, the evidence presented in this experiment revealed no consistent effect of stress on overall intensity. In general, stressed vowels had higher overall intensity than their unstressed counterparts. However, differences in overall intensity between the stressed and unstressed vowels were significant only in the accented condition. In the unaccented condition, there was hardly any difference between the overall intensity of the stressed and unstressed vowels. These results agree with earlier findings by Okobi (2006) for English, Suijter and van Heuven (1996) for Dutch, Ortega-Llebaria and Prieto (2010) for Spanish and Catalan.

Overall, our analysis has substantiated the role of duration as an acoustic correlate of the distinction between stressed and unstressed syllables in both accented and unaccented words. Differences of overall intensity and spectral tilt between stressed and unstressed syllables are more pronounced for accented than unaccented words. Thus, for accented words, there are multiple acoustic parameters, namely, F₀, duration and intensity that conspire to cue prominence. For unaccented words, we have discovered that the prominence contrast is not neutralized, but consistently signaled through durational differences. Unlike previous findings on the phonetic realization of stress in Persian (Abolhasanizadeh et al., 2012; Rahmani, et al., 2015), we found empirical evidence for assuming that Persian features a phonetic distinction between stressed and unstressed syllables. Thus, our results represent acoustical evidence in favor of Jun’s (2005) typological classification of Persian with ‘stress accent’ languages (like West Germanic languages, or languages like Spanish or Catalan), which use multiple phonetic cues to signal prominence, and differentiate stressed and unstressed syllables in the absence of an accent. With respect to the phonological interpretation of our findings, the observation made in this research, namely that duration in stressed syllables is always significantly longer than unstressed syllables, irrespective of accentuation, points towards a stress-based phonological account of word-level prominence in Persian, according to which phonological representation needs to lexically mark prosodic prominence.

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