

# “When two giants meet”: The interaction between lexical stress and utterance-final prosody in spoken Hebrew

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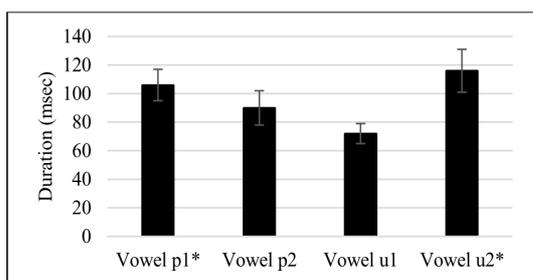
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The present research investigates the interaction between the vowel duration at word level prosody and the phenomenon of phrase-final lengthening, as realized in spoken Israeli Hebrew. Experiments on the relations between the intonational phrase and lexical stress are numerous, and the phonological interaction of lexical and intonational features appears to be of typological interest (Ladd, 2001). Unlike experiments on how words in isolation are uttered, such studies strive to learn how phonological patterns are realized within natural environment, i.e., in an utterance or a sentence. For example, it is a common knowledge that syllables at breath group final position are longer than at its beginning (also known as *lengthening* and *anacrusis*, respectively (Cruttenden, 1997)). Umeda (1975) studied such relations in large scale corpus of read speech. She found that the longer vowels were located at *pre-pausal* syllables, meaning, at stressed syllables by the end of utterance, paragraph, or sentence, to the rate of 1:2 or 1:3. The durational effects of phrase-final lengthening on the domain over which the speakers adjust it were studied in many languages, including Hebrew (Berkovits 1994). Turk and Shattuck-Hufnagel (2007) suggest two domains of the phrase-final lengthening in American English: the main stress syllable and the final syllable of the phrase-final word. They found that although most of the duration increase occurs in the phrase-final syllable rime, statistically significant lengthening of 7–18% also occurs in the main-stress syllable rime, when the main stress syllable is *not* the final syllable. Berkovits (1994) studied Hebrew stress manifestations of seven speakers, and found that utterance-final lengthening principally affected the final syllable regardless of stress. She also found evidence of progressive lengthening along the phrase-final syllable, which supports the suggestion that this phenomenon reflects the motor activity at utterance-final position, as the speech organs are slowing down. Silber-Varod and Kessous' (2008) study on weather broadcasts corpus, showed that stressed syllables in ultimate stress pattern located at intonation unit boundaries are longer than the preceding unstressed syllables, but stressed syllables in penultimate stress pattern are not always longer than the following unstressed utterance final syllables. The current database consists of 68 disyllabic target words in Hebrew, which differ phonemically only in their lexical stress pattern – final or penultimate. Target words were naturally embedded at the end of 68 carrier sentences (compared to six pairs of sentences and 12

disyllabic proper names in Berkovitz (1994)). Thirty subjects (13 Men and 17 Women) received the sentences in written form, and were instructed to read them aloud, pausing for at least two seconds between sentences. The research questions in the current study are: 1. How reliable is the contrast of the durational parameter between stressed and unstressed vowels of the same lexical word (not necessarily with identical vowel)?; 2. How reliable is the contrast of the durational parameter between stressed and unstressed identical vowels in the minimal pair words?

Results show that duration is an intrinsic indicator of stress, meaning the comparisons between stressed and unstressed vowels (p1\* vs. p2, and u1 vs. u2\* in Figure 1) of the same word showed significance differences ( $t(29)=9.446, -19.522$  respectively,  $p<0.001$  for both comparisons). As to the contrast between stressed and unstressed identical vowels (p1\* vs. u1, and p2 vs. u2\* in Figure 1), we found that duration is an extrinsic indicator of stress, i.e. the comparisons between stressed and unstressed identical vowels also showed significance differences ( $t(29)=26.253, 15.718$  respectively,  $p<0.001$  for both comparisons). Utterance-final lengthening affected the duration of the words and vowels. Words were ~26% longer at utterance-final position compared to nonfinal position. As to vowels, across words comparison showed that the effect on the final vowel was the largest, regardless of stress: Second vowels were lengthened to a larger extent (23% in penultimate stress and 18% in final stress) compared to first vowels (7% in penultimate stress and 4% in final stress). Within words comparisons showed a different effect on the two stress patterns: in penultimate words, the gap between stressed and unstressed vowels was reduced in utterance final position (35% in nonfinal; 17% in final position); in final stress words, the gap between stressed and unstressed vowels was *increased* in utterance final position (from 42% in nonfinal to 61% in final position). These findings suggest that although utterance final lengthening does not affect the relative dominance in length of the stressed vowels, it lengthens the last vowels more than the first vowels, regardless of stress assignment.



**Figure 1.** Mean vowel durations in utterance-final position, and 95% confidence intervals of four types of lexical stress conditions (p1\*, p2, u1, and u2\*). Asterisk [\*] symbolizes the stress vowel.

**Table 1.** Means of durations (msec) for penultimate-stressed and final-stressed words in utterance-final position (current study, column B) compared to non-final position (Silber-Varod, Sagi, & Amir 2016, column A) and the study of Berkovits (1994) (columns D-F)

	A	B	C		D	E	F
	Non-final position (msec) (Silber-Varod, Sagi, & Amir 2016)	Utterance-final position (msec)	Difference		Non-final position (msec) (Berkovits, 1994)	Utterancefinal position (msec) (Berkovits, 1994)	Difference (Berkovits, 1994)
<b>Penultimate stress</b>							
Target word	337	424	26%		312	459	47%
Vowel p1*	99	106	7%		-	-	-
Vowel p2	73	90	23%		49**	77**	57%
<b>Final stress</b>							
Target word	336	427	27%		300	422	41%
Vowel u1	69	72	4%		-	-	-
Vowel u2*	98	116	18%		92**	127**	38%

\* Stressed, \*\* In Berkovits (1994), target words had only [i] as the final vowel.

## References

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