

PITCH ACCENT PATTERNS IN ADJACENT-STRESS VS. ALTERNATING-STRESS WORDS IN AMERICAN ENGLISH

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ABSTRACT

In American English, adjacent-stress words exhibit less regularity than alternating-stress words for both main-stress and phrasal prominence placement. Apparently, words with adjacent stress pose a challenge to the prosodic system, possibly because there is a preference for rhythmic alternation in human motor behavior.

INTRODUCTION

Many words of English exhibit alternating stress, in the sense that full vowel syllables occur next to reduced syllables, as in *open* (Full-Reduced), *information* (F-R-F-R), *Appalachicola* (F-R-F-R-F-R), *about* (R-F), *granola* (R-F-R), *communication* (R-F-R-F-R), etc. In some words, however, two full vowels occur in immediate succession, as in *bisect*, *Arlene*, *moron*, *location*, etc. In both types of words, one of the full-vowel syllables is understood to be the main stress syllable, while full vowels that precede the main-stress vowel are often understood to have other degrees of lexical stress. Following Bolinger [3], we contrast full vowels (which carry some degree of lexical stress) with reduced vowels (which do not); in this framework, we refer to words of the first type as **alternating stress**, and of the second type as **adjacent stress**.

In a study of the placement of pitch accents within intonational phrases, we were puzzled to note that adjacent-stress words did not show the same regularity in pitch accent placement that most alternating-stress words did. In the present paper, we report a more systematic study of this difference in pitch-accent behavior, and relate it to additional differences in lexical stress behavior for words with these two

classes of rhythmic or lexical stress patterns.

ANALYSIS 1: LEXICAL STRESS

In earlier work with Ostendorf and Ross [5], we looked at the distribution of pitch accent location within words in a corpus of speech produced by two FM radio newscasters, and labelled for prosodic constituent structure and prominence. We found that a pitch accent did not always occur on the main stress syllable of its word, especially for words that contain a full vowel syllable preceding the main stress syllable, such as *contradict* (F-R-F), *Massachusetts* (F-R-F-R) and *environmental* (?-F-R-F-R). In such words, a pitch accent often occurred on the early full vowel syllable, in patterns that were constrained by both intonation phrase structure and pitch accent rhythm. Details of database construction, prosodic labelling methods, analysis techniques and results are reported in [5], and a summary appears in Dilley et al. (this Proceedings.)

Although these effects were significant for the more than 400 target words in the corpus, there were a number of cases that did not conform to these general rules. Examining the exceptions, we noted that many of them were target words with two full-vowel syllables in adjacent positions. More careful analysis showed that this phrase-level effect was quite systematic, and that there were parallel differences at the level of lexical stress.

Lexical stress. Candidate words for Early Accent Placement must include a syllable to the left of the main stress syllable to serve as a docking site for a possible early pitch accent [1]. We initially developed a criterion for EAP candidate words that specified the early

syllable as a full-vowel, unreduced syllable. In scanning the list of potential EAP candidates in the FM radio news corpus, however, we noticed that for words with alternating stress, such as *institution* and *Mississippi*, it was quite easy to judge whether an earlier syllable was pitch-accentable, and there was good agreement among judges. But for adjacent-stress words like *illegal*, *trustee* and *statewide*, this judgment was more difficult. (This set of words could be defined as having a monosyllabic foot, which places the head syllable of two feet directly adjacent.) Some consisted of two root morphemes (*sometimes*, *southwest*, *shortchange*), some of a prefix plus a root (*predates*, *rehash* (in the verb form), and in some the two strong syllables appeared in a single root morpheme or sequence of root morpheme plus suffix (*primarily*, *minority*, *foundation*).

To resolve this problem for the Early Accent study, we used the secondary stress markings in Webster's 9th New Collegiate Dictionary (1984) to determine whether or not a candidate word had a pre-main-stress secondary stress syllable that could serve as a docking site for a Pitch Accent. However, when we later compared non-main-stress markings in different dictionaries, we again found a contrast: alternating full-vowel words were marked consistently across dictionaries, and their markings almost always corresponded to our common intuitions, but adjacent full vowel words were often marked differently by different dictionaries, or marked with a number of alternate stress patterns, or marked with stress patterns that did not correspond to our intuitions. For example, comparing the stress patterns given by Kenyon and Knott's Pronouncing Dictionary of American English (1944, reprinted in 1953) with those given by Webster's Ninth, for several words in our corpus that were originally candidates for early accent placement, provides the following contrasts ("-" = no stress is marked for this syllable in Webster's, 1 = main stress is marked for this syllable, and 2 = secondary stress is marked for this syllable):

	K&K	Webster
nineteen	-1, 11, 12	(1)1
southwest	21, 12	-1
rehash	-1	(1)1
primarily	12--, -1--	-1--
sometimes	12, -1	12, (2)1

In general, words with adjacent full vowels were less consistently marked for stress than words with alternating full vowels, in two ways: a) they often had more alternative stress patterns listed, and b) these alternative patterns differed not only in whether the early syllable had secondary stress vs. no stress, but also in the location of main stress.

An additional indication that adjacent full-vowel syllables are treated more irregularly by the stress system comes from analysis of words that begin with the prefix *dis-*. When the following syllable is reduced, as in *disagree*, the prefix is regularly marked for secondary stress (e.g. *disability*, *disadvantage*, *disaffect*, *disassociate*, in Webster's Ninth.). But when the following syllable is marked for stress, *dis-* is treated quite variably: in the first ten words of this type listed, 4 have *dis-* marked with no stress (*disable*, *disband*, *disbar*, *disburse*), 4 with possible main stress (*disaggregate*, *disarm*, *disbud*, *disburden*), and three with possible secondary stress (*disadvantageous*, *disapprobation*).

These observations suggested that, even though we excluded from our analysis of Early Pitch Accent words that lacked a secondary stress marker on a syllable preceding the main stress syllable in the dictionary, these markings might be less reliable for potential adjacent-stress than for alternating-stress words. Thus, it might be of interest to analyse the pitch accent placement data separately for alternating full vowel vs. adjacent full vowel words. Results will be reported here for Early Accent candidate words that were labelled with two pitch accents.

ANALYSIS 2: PITCH ACCENT

Double accented words were not uncommon in this corpus, possibly

because newscasters place pitch accents on a higher proportion of accentable syllables than do nonprofessional speakers. Moreover, double accenting occurs more often for alternating stress candidates (26% double accented, 77/295) than for adjacent stress candidates (8% double accented, 11/132). This difference suggests that speakers are not loath to place accents on two stressed syllables of the same word as long as the two syllables are separated by another syllable, but tend to avoid placing accents on adjacent stressed syllables within the word. If confirmed by further analysis and for additional speakers, this observation provides support for the claim that speakers avoid direct pitch accent clash within the word, just as does our earlier findings suggest avoidance of pitch accent clash across word boundaries (if the two words occur within an intermediate intonational phrase).

We took this analysis by word stress pattern one step further, looking at the set of early prominence candidate words that happened to contain all the accents in their intonational phrase. There were three possible pitch accent patterns for these words: a) pitch accent only on an early full-vowel syllable, b) pitch accent only on the main-stress syllable, or c) a double accent, one on each of these two syllables. Our prediction was that these words would contain a higher proportion of double accents than other candidate words, because they were subject to two influences: the requirement that the nuclear accent of the phrase be placed on the main stress syllable of its word, and the tendency to place the first accent in the phrase as early as possible. (By definition, this subset of EAP target words are never deaccented.) On this view, the first factor encourages placement of an accent on the main-stress syllable, and the second factor encourages one on the earlier secondary-stressed syllable.

Overall, the set of candidate words which contained all the accents in a phrase did have a greater likelihood of double accent: 45% (45/101) of these tokens were double accented, while only 14% of word tokens whose phrases also contained other accents were double accented (44/304). We then separated out the results for alternating

stress vs. adjacent stress; results are shown in Table 1.

Table 1. Proportion of EAP target words, containing all accents of their Intermediate Intonational Phrase, that were Early Accented, Main-stress Accented or Double Accented, for a) alternating stress words, and b) adjacent stress words.

	Early	Double	Main	Total
a)	2	41	33	76
b)	7	4	14	25

While 54% of alternating stress target words in this set were double accented (41/76), only 16% of adjacent stress words were (4/25). That is, although speakers tend to double accent EAP candidate words that contain all the accents of the intermediate intonational phrase if they are alternating-stress words, this effect disappears when the main-stress syllable and the earlier full vowel syllable are adjacent, i.e. not separated by a reduced vowel syllable.

DISCUSSION

Although a number of prosodic theories permit double accented words, especially when the word contains the first accent of a phrase (e.g. Gussenhoven [4], Beckman and Edwards [1], Bolinger [3]) we did not expect to find such a high proportion of double accents. It is possible that the FM radio news speaking style has a higher proportion of double accents than other styles, but the fact that they occur freely in this corpus and sound perfectly natural shows that they are fully acceptable according to the grammar of English prosody. Double accents in certain contexts follow naturally from models in which pitch accents are acceptable on the pre-main-stress full vowels of a word, as well as on the main-stress vowel.

The finding that adjacent full vowels or stressed syllables are treated more irregularly by the prominence assigning component of the prosody emerges from both the anecdotal evidence about lexical stress marking in dictionaries,

and from the empirical results for Early Accent Placement. An additional small piece of evidence that adjacent stress words are associated with greater irregularity in prominence placement comes from analysis of the target EAP words which did not follow the general rule for locating phrase-final (i.e. nuclear) accents on the main-stress syllable of their word. This general tendency was very strong in our corpus, providing evidence that the prosody labellers were consistently finding the boundaries of intermediate intonational phrases [2], for which the nuclear accent is proposed to fall on the main-stress syllable of its word [2], [4] and others). However, there were five exceptions to this general rule, i.e. five EAP candidate word tokens which contained the nuclear accent of their phrase, but were accented on their early secondary stress syllable only, rather than on their main stress syllable or on both. In contrast, for none of the 90 alternating stress words with a nuclear accent was it placed on the early syllable only. Although the number of exceptions is small, that fact that they occurred only for adjacent-stress words again suggests that this stress pattern challenges the prominence placement rules of English prosody.

CONCLUSIONS

This analysis of Early Pitch Accent in alternating-stress vs. adjacent-stress words in a corpus of continuous communicative speech suggests three points. First, in studying phenomena related to early prominence in the word, either in analysis of the behavior of candidate words in speech databases or in selection of stimulus words for experimental speech elicitation, this contrast in rhythmic stress pattern should be considered. It is possible that alternating stress words will provide a clearer measure of the effects of the various factors that influence Early Accent. In fact, there is much we do not understand about the factors that constrain both secondary lexical stress and Early Accent Placement. For example, some full vowels that are not marked with secondary stress appear to resist early accent (e.g. *Montana*), whereas others accept it freely (e.g.

illegal, which was often produced with early accent in our FM radio news corpus). The categorization of a pre-main-stress full vowels in words of English as having some degree of lexical stress or not, and as capable of carrying a pitch accent or not, requires further work, at least for words with adjacent full vowels. Second, since it would be assumed that a pitch accented word will be accented on its main-stress syllable, studies of the acoustic correlates of different pitch accent types will require labelling of pitch accent locations by syllable rather than by word, at least for Early Accent candidate words that include a full vowel syllable preceding the main-stress syllable. Finally, the observation that speakers prefer not to pitch accent adjacent syllables, either within words or across word boundaries, is consistent with the claim that human speakers prefer to alternate more prominent with less prominent elements in an utterance if they can.

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