

## **Output-Output Faithfulness to Moraic Structure: Evidence from a New Phenomenon in American English**

The relationship between coda content and vowel length in English monosyllabic content words is well established (see (1)): vowels are longest in open syllables, and closed syllables have shorter vowels with two coda segments than with one (Munhall et al. 1992). New research shows systematic deviation from this pattern in morphologically complex words. Three production experiments demonstrated that, for native American English speakers from various regions, vowels in dimorphemic monosyllabic words (*sighed*, *passed*) are consistently longer than in monomorphemic words composed of the same segments (*side*, *past*). This finding will be explained by Output-Output faithfulness (Benua 1997) such that *sighed* has a longer vowel than *side* because it matches the moraic structure of its base, *sigh* (which is predicted by (1) to have a longer vowel than *side*).

Eight participants (Exp. 1) and 20 participants (Exp. 2) read target words presented on note cards. For each dimorphemic word (“di word”), there was also a “homophonous” monomorphemic word (“mono word”). The results of these experiments show that the vowels of the di words are longer than in the mono words by 5-10% (which approximates the increase in vowel length from monomorphemic VCC to VC (Munhall et al. 1992)). In the third experiment, 13 participants read the relevant words in a frame sentence (*I said side not sighed*) designed to emphasize the potential differences in the words, yielding a vowel length increase of 11-17% in the di words. Fig. 1 summarizes these results, which demonstrate that, in American English, monosyllabic di words composed of a verb + ‘past tense’ morpheme (realized as [t] or [d]) have longer vowel durations than mono words of the same segment content. Additionally, this difference in vowel length is larger when the words are under a contrastive focus.

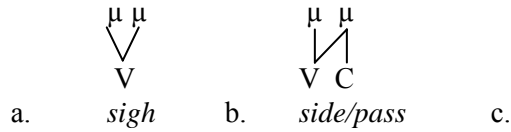
Broselow et al. (1997) evaluate the correlation between phonetic length and phonological weight, concluding that, while bimoraic segments are often twice as long as monomoraic ones, there are more subtle length distinctions that result from mora sharing, in which a segment that exclusively bears a mora is longer than if that same segment shares a mora. Accordingly, the length hierarchy in (1), is modeled in (2), in which all the syllable types are bimoraic. The di words have a vowel length that is expected of their base, which follows from O-O faithfulness to the moraic structure of the base (utilizing Morén’s (2003) constraints MAXLINK-MORA and DEPLINK-MORA with a change in the correspondence strings from I-O to O-O), and the resulting syllable structures are shown in (3). The shared moras in (2b&c) and (3b) differ from common conceptions of English syllables where coda consonants exclusively bear a mora or are weightless (for example, Cohn 2003). Without mora sharing, previously proposed syllable structures cannot explain the fine but consistent length distinctions in English monosyllables.

An alternative explanation using the relative frequency of similar lexical items is demonstrated by exemplar-based models (for example, Pierrehumbert 2001). Due to phonetic and/or morphological similarity, both the base and the mono word have the potential to influence the di word (either causing assimilation or dissimilation), meaning that the di word would be more influenced by whichever is more frequent of the base or mono word. If this is the case, we would expect that di words either increase or decrease in similarity to the mono words (measured by length ratio) in a linear fashion with an increase in the frequency of the mono words with respect to the base. Fig. 2 shows the results of Exp. 2 by word. The length ratio for each di word to its mono partner as averaged among all speakers is compared to the ratio of the frequency (as cited in CELEX) of the base to the mono word. The graph’s x-axis displays the log of this frequency ratio, as this formula has been shown to resemble how native speakers judge the familiarity of words in their language (Smith & Dixon 1971). The scattered points of Fig. 2 (as opposed to a rising or falling linear formation) tell us that frequency is not a factor.

Currently a new production experiment is underway to clarify the results displayed in Fig. 2, but the preliminary conclusions are 1) Frequency of the two words whose exemplars could influence the di word is not significant, and 2) O-O faith with respect to the moraic structure of the base will account for this novel phenomenon in which di words have a longer vowel than mono words composed of the same segments. Specifically, because *sighed* is composed of *sigh* + *d*, unviolated O-O faithfulness constraints force the di word to match the moraic structure of *sigh* even though in the “homophonous” *side* one of the moras attached to the vowel would be shared with the [d], resulting in a shorter vowel.

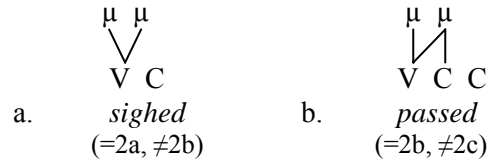
(1) Predictable vowel length variations due to coda content:  $V > VC > VCC$

(2) Monomorphemic syllable structures\*:



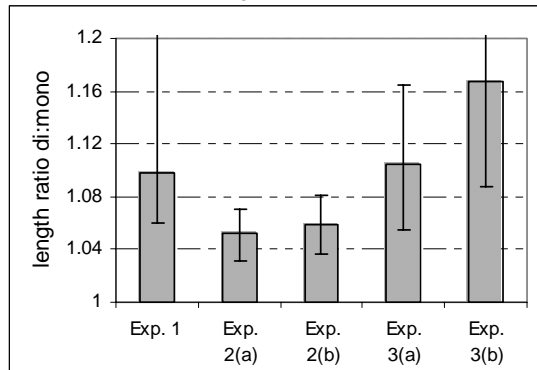
\*onsets not shown for simplicity

(3) Dimorphemic syllable structures\*:



**Figure 1**

Results of Three Production Experiments:  
average length ratios di:mono  
(sighed:side)



legend to figure 1

measurements used by experiment:

**Exp. 1:** CV length (onset + nucleus) – used to maximize accuracy (all onsets were stops)

**Exp. 2a:** V length

**Exp. 2b:** V+ length (nucleus + inseparable liquid) – used to maximize accuracy

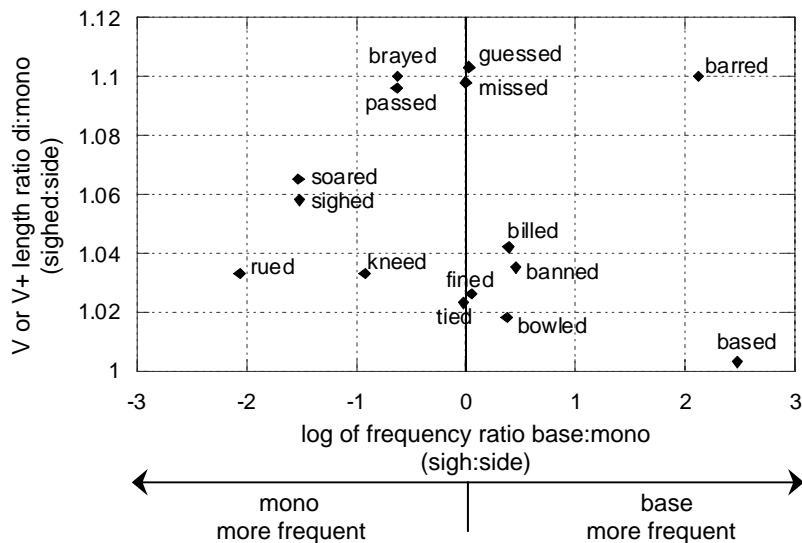
Exp. 3: V length; words compared were in same context, i.e. in the two sentences *I said side not sighed* and *I said sighed not side*, for **Exp. 3a:** first underlined word of each sentence forms comparison, for **Exp. 3b:** second underlined word of each sentence forms comparison

I = 95% confidence limits

Exp. 1:  $p = .0030$ , all other Exp.:  $p < .0001$

**Figure 2**

Results of Exp. 2: Frequency not a factor



**Select References:**

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