# A LONG-SHORT VOWEL DICHOTOMY IN FLUENT ENGLISH?

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## ABSTRACT

American English vowels are usually put into two categories: long vs short or tense vs lax, the supporting data coming from non-spontaneous speech. Duration data from free conversation are consistent with this view, in that /ɪʊɛʌ/ are shorter than /ioeuaɔæ/. But /ɪʊɛʌ/ occupy a range of durations that is not in any sense discontinuous with the range of durations manifested by the remaining vowels of the language.

## INTRODUCTION

The vowels of English have long been said to fall into two categories, involving a dimension [±long] and/or [±tense] and/or [±ATR] (advanced tongue root). There are both phonological and phonetic motivations for making this division. Among the latter is the view that in the particular pairs /ɪ-i/ /ʊ-u/ /ɛ-e/ a salient difference between the first and second vowels is durational, which might perhaps be "explained" by a difference in either tensity or in the position of the root of the tongue. However all the vowels of the language are usually assigned to one or the other category, even if not all those of one of the categories are unequivocally paired with particular members of the other. Of course, all the pairings proposed involve clear differences in timbre. Here we will put to one side any consideration of "tensity" or tongue-root position, focussing on length, an auditory attribute that ostensibly corresponds to the measurable duration of the "vocalic stretch" in an acoustic signal. Although the phonological literature does not show complete agreement on the membership of the two categories, there is considerable overlap among the various classifications that have been proposed. Thus everyone reports /ɪʊɛʌ/ as short or lax, while /iueo/ are long or tense. The status of /ɑɔæ/ is less clear. So for Goldsmith [1] /ɪɛæʌɑʊɔ/ are short, all others long. But others view /ɑ/ and /æ/ as being long. From a presumably more phonetic perspective, however, /æ/ has been called lax (and therefore short?) as against the tense /ɑ/ [3]. Confounding the issue is that vowel height is also a determinant of vowel duration, low vowels being longer than high ones [4]. For certain views expressed on the matter it is unclear whether the long-short (or tense-lax) classification is phonetically based or is rather motivated by phonological (including phonotactic) considerations. The best known phonetic study of the matter [2] supports the view that /ɪʊɛʌ/ are relatively short, but does not clearly suggest a short-long dichotomy (Fig.1).

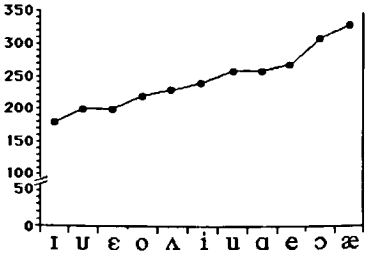


*Figure 1. Rearrangement of the mean vowel durations for five speakers reported in Peterson and Lehiste (1960).*

Thus we find no greater difference between the "short" /ʌ/ and long /i/ than between many other adjacent or near-adjacent pairs not considered to differ in either length or tensity, e.g. /ɪʊ/ /ʊʌ/ /ɛʌ/ /ue/ /eɔ/.

The present study was undertaken to gather evidence from spontaneous speech on the robustness of relative duration as an acoustic correlate of the generally accepted vowel length distinction in American English.

## PROCEDURE

In two separate sessions, of about ten minutes each, a pair of native speakers of American English, one female and one male, were recorded while engaged in informal spontaneous conversation. Four speakers in all participated. The recorded speech, digitized at 22 Kh, was subjected to FFT analysis by means of the Signalyze' program. Signal intervals corresponding to stressed vowels between obstruent consonants were selected on the basis of auditory, waveform and spectrographic criteria, and their durations were defined as the interval from release of the prevocalic constriction to the onset of the following constriction. Excluded from consideration were vowel tokens judged auditorily to have been produced with either "contrastive stress" or "drawling." as well as the three diphthongs /aʷ ɑʲ ɔʲ/ and the retroflex vowel [ɚ]. The measurement data thus assembled were classed by phonological category, and the categories grouped into "short" and "long" sets. For the present purpose we elected to apply two classifications, one where /ɪʊɛʌ/ are short and all the others long, and a second in which /ɪʊɛ/ represent the short vowel set and /iue/ are their long counterparts. Given the nature of the speech samples, the numbers of tokens for the different phonological categories and durational sets were expectably quite unequal.

Although a division of the English vowels into long and short sets appears to be solidly enough based to call for no more data collection based on unspontaneous speech, a set of "control" data was gathered from a single speaker producing forms of the type /bVt/ and /bVd/ in a carrier Please pronounce — once again. The target "words" in this context were regularly produced with voiceless /b/ and non-flapped allophones of the final alveolar consonants, and were subjected to the same recording, signal processing and analysis applied to our samples of spontaneous speech.

## FINDINGS

As we have seen, the vowel duration data presented in [2] do not provide the strongest possible evidence for a dichotomous separation into short and long sets. Thus even the single speaker data in [2], with no scope for interspeaker variability, show /ʊ/ and /ʌ/ differing by 30 ms, while for /ʌ/ vs /i/ the difference amounts to all of 3 ms. Our own single-speaker control data (Fig. 2) are much more consistent with a short-long dichotomy, since the durational differerence between the adjacent pair /ʌ/-/i/ shows a significance level (unpaired t-test, df 38, t = -6.3. $p \leq .0005$) matched only by that for /ɪ/-/ʊ/.

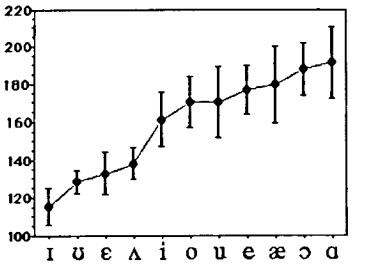


*Figure 2 . Means ± one standard deviation of vowels (20 tokens each) produced in a fixed carrier sentence by one speaker.*

Turning now to the spontaneous speech data, we find mean durations and standard deviations for the eleven vowel categories measured as shown in Fig. 3.

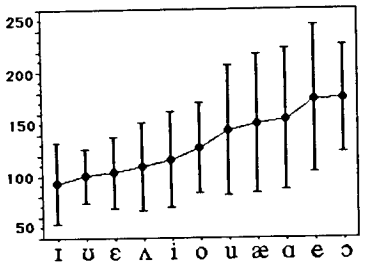


*Figure 3. Mean vowel durations(ms) ± one s.d. for our four speakers*

This picture is closer to the one in Fig. 1 than in Fig. 2, in that while /ɪʊɛʌ/ are shorter than any of the others, the division between the "short" /ʌ/ and the "long" /i/ is no greater than those of /o/–/u/ or /ɑ/–/e/. It would seem, then, that at the "superficial" phonetic level, i.e. where physical measurement may be relevant, there is no clear basis for a sharp cleavage between long and short vowels in spontaneous English. Of course, if we group /ɪʊɛʌ/ as "short" and all the others as long, then we shall certainly find mean group durations that are significantly different, as the individual speaker data in Table 1 indicate.

*Table 1.Mean durations in ms: means, standard deviations, and significance levels per unpaired* t-*tests.*

| Spkr: | DS | DL | MC | JH |
|---|---|---|---|---|
| /ʊɛʌ/ | | | | |
| M | 108 | 98 | 99 | 92 |
| SD | 46 | 35 | 30 | 16 |
| n | 45 | 101 | 44 | 25 |
| /iueɔæɑ/ | | | | |
| M | 181 | 134 | 143 | 125 |
| SD | 67 | 52 | 45 | 40 |
| n | 43 | 81 | 59 | 25 |
| df | 87 | 174 | 101 | 48 |
| t | -6.0 | -4.9 | -5.6 | -3.8 |
| $p <$ | .001 | .001 | 001 | .001 |

When these grouped data are summed across the four speakers we see just what we should expect (Fig. 4). The mean for the four shortest vowels is of course smaller than the other, but the two means are separated by an amount that almost exactly equals the average of the standard deviations of the two groups.

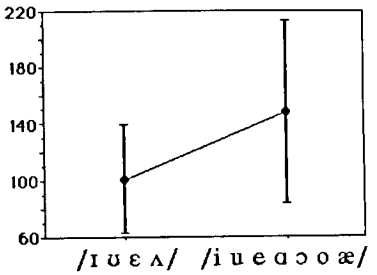


*Figure 4. Means ± one s.d. for the summed data of Table 1*

If our spontaneous speech data fail to show any sharp division between short and long vowels, they certainly do not encourage the supposition that this failure is the result of a faulty length assignment of the (to some) questionable vowels /æɑɔ/, since moving one or more of these to the "short" category would hopelessly weaken any case for a long-short (or tense-lax) distinction based on a phonetic length difference.

*Table 2 .Mean durations in ms: means, standard deviations, and significance levels per unpaired* t-*tests.*

| Spkr: | DS | DL | MC | JH |
|---|---|---|---|---|
| /ɪʊɛ/ | | | | |
| M | 112 | 93 | 95 | 92 |
| SD | 48 | 29 | 21 | 16 |
| n | 33 | 83 | 22 | 22 |
| /iue/ | | | | |
| M | 203 | 129 | 140 | 114 |
| SD | 67 | 53 | 47 | 42 |
| n | 14 | 28 | 34 | 9 |
| df | 45 | 109 | 54 | 29 |
| t | -5.3 | -4.5 | -4.3 | -2.2 |
| $p <$ | .001 | .001 | .001 | .03 |

To do justice to the literature on vowel length in English, we should point out that many studies restrict attention to three vowel pairs: /ɪ/–/i/, /ʊ/–/u/, /ɛ/–/e/. The data for the shorter vs longer vowels of this restricted subset (Table2) show that for each speaker the two vowel sets differ significantly in their mean durations. At the same time it may be noted that JH produced his long vowels with durations scarcely greater than those of DS's short vowels. When the data are pooled across speakers their means and standard deviations are as shown in Fig.5. It is evident that while there is a difference between the means of pooled short and long vowels, a large proportion of the short vowels lie well within the range of values characteristic of their long counterparts.



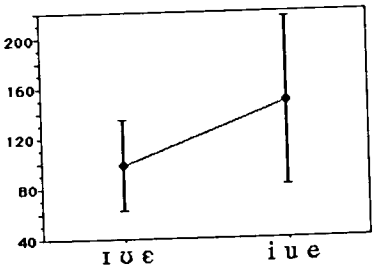


*Figure 5. Means ± 1 s.d. for pooled data of Table 2.*

## CONCLUSION

There is every reason to believe that the vowels of English (and very likely all other languages as well) show regular differences in duration, at least according to the commonly accepted definitions of vowel onset and offset. It is less certain that the American English fall into two distinct subsets, short vs long. A partitioning of these vowels into short and long categories, insofar as it is phonetically based, rests on data derived from speech carefully selected to eliminate a variety of factors affecting speech timing generally,– speaker variability; overall speech tempo; contextual factors, e.g. immediate phonetic context, place within word, phrase or utterance. If speech data gathered under controlled conditions **do** indicate a short-long dichotomy (as per the data of Fig.2), and if phonetic/phonological classification appeals to this sort of data, then it appears that in spontaneous speech there are factors at work (controlled for in laboratory speech) powerful enough to blur, if not entirely obliterate, durational differences that might be considered to be inherent properties of the vowels themselves.

## ACKNOWLEDGEMENT

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## REFERENCES

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