SESQUISYLLABLES OF ENGLISH: THE STRUCTURE OF VOWEL-LIQUID SYLLABLES

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ABSTRACT

We investigate monosyllabic words with rimes consisting of a diphthong or non-low tense vowel followed by a liquid, such as *file, foul, foil, feel, fool, fail; fire, flour* and *foyer*, which we term *sesquisyllables*. Evidence from phonological distribution, speaker intuition, metrical properties, variant pronunciations, and an acoustic study converges on the interpretation that these are trimoraic monosyllables. Comparison of durations for V, Vd, Vl, and Vld rimes for low vowels and diphthongs revealed systematic duration differences attributable to proposed mora count. The CV and CVd cases, both argued to be bimoraic, are closely parallel in duration. However there is a systematic difference for the CVl and CVld cases, argued to be bimoraic for low vowels and trimoraic for diphthongs. We account for these results by integrating the assignment of duration to moras and segments.

1. INTRODUCTION

Linguists and native speakers alike have strong intuitions about the syllable count of words. Yet in one class of words, such intuitions seem to break down. These are the rimes consisting of diphthongs or non-low tense vowels followed by a liquid, for example:

(1) /l/-rimes: *file, foul, foil; feel, fool, fail*
/r/-rimes: *fire, flour, foyer*

These cases fall somewhere between the clear monosyllables and clear disyllables. Consider the continuum in (2).

(2) Monosyllabic Disyllabic
pill pole pool peel pail foil pile powell paddle*
*and *fell, pull, Paul, pal, Sol, dull*

It is this property, and the fact that they can often be produced as disyllables, that gives the feeling that they are more than a monosyllable; we refer to these as the *sesquisyllables* (*sesqui*, from Greek, one-and-a-half) of English.

In this paper, we examine the structure of these rime types by looking at their phonological distribution and phonetic realization. We investigate phonological distribution and speaker judgments, and present the results of a preliminary acoustic study. The evidence from each domain converges and we argue that they are indeed monosyllables, but that they are trimoraic, as shown in Figure 1 for *tire* and compared to a bimoraic syllable such as *tie.*

There is evidence of controversy over the status of these syllables. Although Kenyon and Knott [4] list the sesquisyllables as strictly monosyllabic, such that *veal* is [vil] and *fire* is [faɪr], our intuitions closely correspond to those of Moser (1969) [8].

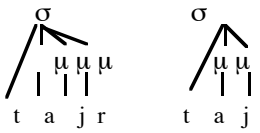

Figure 1. Mora association for *tie* and *tire*.

In *One-Syllable Words*, Moser organizes the nearly 14,000 monosyllabic words of English that he compiled over a 30-year period, conveniently parenthesizing words that he suggests may be pronounced with either one or two syllables—our sesquisyllables. Moser states: "Dictionaries follow the conventional spelling form in indicating the number of syllables, although exceptions are made. Words enclosed in parentheses—(veal), (fire)—are words that, according to the dictionary, may be pronounced with either one or two syllables [1:xii]." Pronunciations given in *Webster's Ninth New Collegiate Dictionary* [10] offer either monosyllabic or disyllabic interpretations of the sesquisyllables, with optional schwas between the nucleus and the coda liquid. While we agree with most of Moser's judgments, we differ in a few systematic ways, which we note in the course of our analysis.

Despite the lack of consensus on how to characterize these syllables, to our knowledge, no systematic phonetic or phonological studies have been done to better understand this class of monosyllables. To account for the observed distribution, we suggest an Optimality Theoretic [6, 9] account, whereby a constraint banning trimoraic syllables (inviolable in many languages) is violated to satisfy a higher ranking constraint requiring /r, l/ to bear a mora in the syllable rime.

2. PHONOLOGICAL DISTRIBUTION OF SESQUISYLLABLES

Table 2 represents our intuitions about the weight status of monosyllables of American English. All of the allowable vowels (lax, tense, and true diphthongs) appear vertically along the left. (Unlike Moser and some other researchers, we do not include /ju/ as a single unit.) In the columns to the right, we indicate which of these vowels can be followed by /r/ and /l/ and compare these with the vowels that can occur in open syllables. A sample word is provided for all attested combinations. Before /r/, the tense/lax distinction is neutralized which we indicate by merging the relevant cells. Combinations that we argue are sesquisyllabic are marked with a double outline.

merged vowels	sesquisyllable	— non-occurring

Table 1. Key to table 2.

	r	l	Ø
ɪ	peer	peel	pea
ɪ		pill	—
e	pear	pale	pay
ɛ		pell	—
æ		pal	—
a	par	pol	pa
ʌ	(purr)	hull	—
ɚ	—	pearl	purr
u	poor	pool	Pooh
ʊ		pull	—
o	pour	pole	Poe
ɔ		Paul	paw
aj	pyre	pile	pie
aw	hour	owl	paw
oj	foyer	foil	poi

Table 2. Monosyllables and sesquisyllables.

First consider the case of /l/ which can occur postvocalically after all vowels, even /ɚ/ (a sound whose treatment as a single unit or sequence we have not fully determined yet). After lax vowels and low vowels, the resulting forms are clearly monosyllabic. After diphthongs and non-low tense vowels (except /o/), the resulting syllable is clearly heavier than a regular syllable. There is an interesting difference between /o/, which does not seem to be more than a monosyllable, and the other non-low tense vowels. Moser indicates that /ol/ rimes as sesquisyllabic, an analysis that we and our subjects do not agree with.

The case with /r/ is a bit more complicated, due to the vowel mergers before postvocalic /r/. Among the non-low vowels, there is no tense-lax distinction. (In our speech /æ/ also neutralizes in this environment.) One author feels that the lax member of each pair occurs, while the other feels that the vowel that surfaces is somewhere in between. In any case, these rimes are clearly monosyllabic. Moser indicates both tense and lax variants as alternant pronunciations, and indicates the lax variants as being more than monosyllables, an observation that we do not agree with. The vowels, /a, ʌ/ also surface before /r/, again producing monosyllables. The diphthongs, on the other hand, result in something heavier than a regular syllable.

Crucial to understanding this pattern is the grouping of vowels in English. There are: (1) the lax vowels which we take to be monomoraic, (2) the tense vowels which we take to be bimoraic and (3) the true diphthongs which we also take to be bimoraic. We reserve the term "diphthong" for the true diphthongs and do not include the tense vowels with diphthongal offglides. In addition, vowel height plays a crucial role, with the low vowels behaving differently from the non-low vowels.

While some have argued that trimoraic syllables are impossible, under Optimality Theory, the constraint against them is violable constraint like any other constraint. We believe, however, that the trimoraic syllable is an inherently unstable structure, resulting in the perceived or real variation in pronunciation as one or two syllables. We take dialect differences in realization of these syllables as additional evidence of their instability.

Mora affiliation in English is for the most part a matter of context. We argue that coda consonants generally receive moras only if necessary to meet the bimoraic word minimum. For example, any consonant in a monosyllable after a lax vowel nucleus will receive a mora. The fundamental intuition of our analysis is that not only vowels, but also approximants in the rime, are inherently moraic. While *μμμ is highly ranked cross-linguistically and inviolable in many languages, there are languages which allow trimoraic syllables [2], such as Hindi [1] and Sinhala [5]. In English, it appears that despite quite complex codas, syllables are generally bimoraic at most, yet in precisely the cases of the sesquisyllables, trimoraic syllables arise. This results from a constraint on /r, l/ in the rime whereby they must bear a mora. This constraint outranks *μμμ.

(3) RIMER/L: Liquids in the rime must bear a mora.

(4) *μμμ: No trimoraic syllables are allowed.

RIME R/L differs crucially in this respect from n/m whose moraic affiliation is determined solely by context.

Despite the bimoraic status of the low vowels /a, ɔ/ (as evidenced by their ability to appear in open syllables), they do not result in trimoraic syllables when followed by a liquid. This is not explained by the ranking of the two constraints though we believe that this is the result of sonority differences and follow Morén 1997 [7] in believing that /o/ patterns with /a, ɔ/ in this respect.

While this analysis accounts for our intuitions about the distribution of trimoraic syllables, we now provide several converging sources of evidence for the existence of trimoraic syllables/sesquisyllables. This evidence includes metrical facts, and dialect differences as well as a systematic study of speaker intuition and the results of a preliminary phonetic study.

3. EVIDENCE FOR SESQUISYLLABICITY

3.1. Speaker Intuition

Six subjects—A, B, C, D, E, F—all native speakers of northern dialects of American English, filled out a syllable count questionnaire. The 170 questionnaire items systematically represented all possible combinations of vowel plus coronal stop or sonorant and included numerous pairs which are either minimal pairs or homophonous like *hire/higher* and *oil/loyal.* We included the coronal stop codas as probable unambiguous monosyllables and the coronal sonorant codas as probable sesquisyllables. Filler items consisting of canonical 2 and 3 syllable words were also included in the randomized list. Table 3 lists the categories of words examined and examples.

Pattern	Sample Words
1 syll, final d	*bid, bead, bide*
1 syll, final t	*bit, beet, bite*
1 syll, assorted final C	*aim, beige, choice*
? syll, final l	*fill, feel, fail, file*
? syll, final r	*fir, fear, fair, fire*
? syll, final n	*fin, seen, fine*
homophonous sets	*flour, flower; hire, higher*
2 syll, syllabic resonant	*apple, bottom, kisser*
2 syll, unambiguous	*clambake, valley, mushroom*
3 syll, unambiguous	*cantaloupe, tambourine, volcano*

Table 3. Syllable count questionnaire categories and examples.

Speaker judgments were strikingly consistent, that is, each subject was internally consistent in evaluating the forms; similar forms were given similar judgments. Subjects correctly identified the number of syllables in the polysyllabic words. For the more ambiguous words, the six subjects fell into two major groups with respect to their judgments. Judgments were internally consistent and subjects either found *all* forms to be monosyllabic or found precisely the predicted sesquisyllables to be 1.5 or 2 syllables. Table 4 summarizes the speaker judgments. Among these six speakers, there are three distinct, systematic patterns.

	l		r	
syllables:	1	1.5 or 2	1	1.5 or 2
lax	ABCDEF		ABCDEF	
tense	BCE	ADF	BCE	
diphthong	BCE	ADF	BE	ACDF

Table 4. Subject ratings of syllables.

3.1.1. Uncontroversially Monosyllabic. All low and lax vowels before /l/ were monosyllabic for everyone. The mid vowel /o/ patterns with the low vowels in being uncontroversially monosyllabic when followed by /l/. For all speakers, /ɛ, ʊ, ɔ, a, ɚ/ followed by /r/ were monosyllabic. For one speaker, /ɪr, ʊrd, ɔrn/ were slightly more than monosyllabic. And for two speakers, /ɪrd, ɚl/ were slightly more than monosyllabic.

3.1.2. Uncontroversially Disyllabic. For almost all subjects, *vial*, *loyal*, and *dowel* were disyllabic. In these cases, the orthography, independent of the morphology, had a strong effect on the syllable count. For all speakers, /ɚl, ir (except one), er, or, ur/ were disyllabic. When suggested by the spelling or perceived morphological structure, /ajr, ojr, awr/, were disyllabic, as in pairs like *lyre/liar* and *flour/flower*. There is a clear influence from orthography (and sometimes morphology) that overrides speakers' other intuitions about these forms, though without analyzing subjects' speech, it is unclear whether the orthography influences the subjects' production or just their judgments.

3.1.3. Split Cases. For the rest of the cases—tense /il, el, ul/ and diphthongs /ajl, ojl, awl/—there is a split between the speakers. Speakers B, C, E, interpreted these words as monosyllabic whereas speakers A, D, F, interpreted nearly everything else as more than one syllable, whether 1.5 or 2 syllables. For subjects B and E, /ajr, awr/ are monosyllabic unless the spelling suggests that they are disyllabic. For subjects C, A, D, F, /ajr, awr/ are more than monosyllabic.

Without further acoustic study, we cannot tell if the subjects produce any phonetic differences paralleling their judgments. We predict slight phonetic differences for morphologically complex sesquisyllables but no phonetic differences due strictly to the orthography. This could be tested through a production study, but perhaps equally well with a perception study where duration is varied to determine if subjects perceive any systematic difference in meaning, particularly in homophonous pairs like *tire* and *tier* (one who ties).

3.2. Metrical Evidence

Evidence from chanting and verse can provide additional evidence of syllable count. Bruce Hayes has suggested using the chanting intonation as a diagnostic. In our own speech, we find that those which we take to be sesquisyllabic can be chanted in a manner similar to disyllabic words. To create an onset for the "second" syllable, a vocalic onset (glide) is included in contrast to single monosyllables where this is not an option and hiatus is observed.

(5)	disyllabic	*table*	te-bl
(6)	sesquisyllabic	*peel*	pi-jl
		fire	faj-jr
		owl	aw-wl
(7)	monosyllabic	*pill*	pɪ-ɪl, *pɪ-jl
		far	fa-ar, *fa-jr
		all	a-al, *a-jl, *a-wl

We predict that in emphatic speech, speakers will have a greater tendency to produce disyllabic renditions. Traditional verse could provide examples of how these forms are scanned: as one or two syllables (Hayes, Bowers, p.c.). These are areas in which speaker judgments could be further tested.

3.3. Dialect Variation

Sesquisyllables display a great deal of dialect variation. Although we have not had the chance to investigate it systematically, dialects do differ in their tendencies to diphthongize the tense vowels and monophthongize the diphthongs. The diphthongized tense vowels often lead to an uncontroversially disyllabic interpretation of some of the sesquisyllabic words. This is an area for further research which fits in well with our general stance that the trimoraic syllables are inherently unstable and thus dispreferred. We turn now to our acoustic study.

4. ACOUSTIC STUDY OF L-RIMES

Recent evidence supports the view that moraic structure can be observed in terms of phonetic duration [1, 3]. While this evidence is convincing, segments themselves also contribute to duration so an integrated model, along the lines of Ham 1998 [2], is clearly needed. Our acoustic study is designed to determine the phonetic realization of the sesquisyllables by systematically investigating these and non-sesquisyllables. Arguing that duration is derived from both mora and segment count, we predict that the sesquisyllabic rimes will show longer overall duration than similar rimes with non-liquids. That is, all else being equal, a trimoraic syllable will be longer than a bimoraic syllable.

4.1. Methods

Real English words of the shape CV(C)(C) were studied. Vowels included /i, ɪ, u, ʊ, a, ɔ, aj, aw/. The initial consonant in all cases was a voiceless fricative, /s/ or /f/ if possible. The rime consonants included /l, d, ld/. Two female American English speakers read four repetitions of each of these words in the frame sentence *Please say* _____*for me*, of which three were analyzed.

4.2. Results

Systematic differences in duration, correlating with the proposed differences in mora count, were found. As a comparison of Figures 2 and 3 reveals, the vowel plus /l/ rimes are systematically longer than the vowel plus /d/ rimes. The top two bars of each figure show the vowel or diphthong and the bottom two bars show the vowel or diphthong plus /l/. In each pair, the bottom member has /d/ as well. In all of the cases studied, /d/ contributes a duration of about 55 ms, showing the duration of /d/ to be independent of moraic structure, in contrast to Vl nuclei (as

compared to V nuclei) which have additional duration from the presence of /l/.

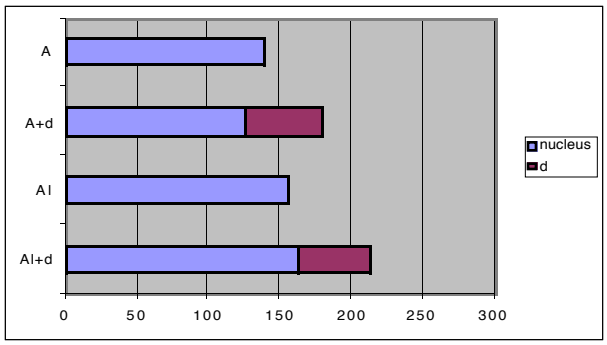

Figure 2. Averaged durations for low vowels (A) in Ø, d, l, and ld contexts.

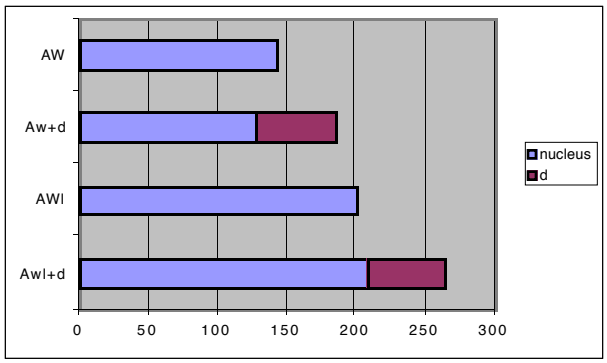

Figure 3: Averaged durations for diphthongs (AW) in Ø, d, l, and ld contexts.

Comparing, for example, low vowels (A) with diphthongs (AW), we find that the CV and CVd cases, both argued to be bimoraic, are closely parallel in duration. For the CV cases, the average low vowel duration is 139 ms and the average diphthong duration is 143 ms. For the CVd cases the average low vowel duration is 126 ms with an additional 52 ms for /d/. For the CVd diphthong cases, the average diphthong duration is 128 ms with an additional 57 ms for /d/.

For the V+l cases, there is a systematic difference for the CVl and CVld cases, argued to be bimoraic for low vowels and trimoraic for diphthongs. For the CVl cases, the average Vl duration is 154 for the low vowels and 201 for the diphthongs. For the CVld cases, the average duration for the low vowels is 162 plus 51 ms for /d/ and for the diphthongs is 207 plus 58 ms for /d/. We account for these results by integrating the assignment of duration to moras and segments.

5. CONCLUSIONS

We have offered a systematic study of a previously unexamined topic in English syllable structure, that of vowel-liquid monosyllables. Our phonological analysis accounts for these facts by ranking a constraint requiring liquids to bear a mora in the syllable rime over a constraint banning trimoraic syllables. Converging evidence from phonological distribution, phonetic duration of /l/-rimes, and speaker intuition supports our proposal that they are trimoraic syllables. Rime /l/ is shown to contribute to duration of the syllable in a way that rime /d/ does not, supporting our claim that rime /l/ is moraic. These results support a model of timing which directly integrates segments and moras.

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