On the role of morphology, syllable structure, frequency and spelling in English vowel reduction
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**VOWEL REDUCTION IN ENGLISH**

In English, many vowels reduce when unstressed.

- **atom** → *ət*
- **atom** → *əm*
- **fate** → *fət*
- **fate** → *fət*
- **eponym** → *əˈpɒnɪm*
- **eponym** → *əˈpɒnɪm*

We take reduced vowels (e' / ə / ɪ / ʊ / u / i) to be defined as in Crouch (2014: 158): “these are the short vowels with a central or centralised quality (apart from final i /ɪ/) and are the least prominent syllables.”

However, reduction is not systematic: some words have full vowels in unstressed position, while others have reduced vowels.

A different number of factors have been claimed to influence vowel reduction.

**POSSIBLE FACTORS**

- **Syllable structure:** vowels in open syllables are more likely to reduce than vowels in closed syllables (Buzzio 1994: 113; Fudge 1984; Halle & Keyser 1971).
- **Nature of the codas:** vowels in syllables closed by obstruents are less likely to reduce than vowels closed by coronals (Buzzio 1994; Dahak 2011; Fudge 1984; Ross 1972).
- **Reduction:** initial pretonic closed syllables normally do not reduce except if that syllable is a semantically opaque prefix (Chomsky & Halle 1968: 118; Guiere 1979: 253; Liberman & Prince 1977; Pater 2000; Selkirk 1980).
- **Spelling:** vowels spelled with a digraph reduce less than monographs, especially in the initial pretonic position (Dahak 2011; Deschamps et al. 2004: 217).
- **Word frequency:** more frequent words show more reduction than less frequent words (Fikelholtz 1975).
- **Existence of a base:** the existence of a morphological base in which the vowel is stressed can diminish its chances to reduce (Chomsky & Halle 1968: 112, e.g. *red* → *reduced*, *relevance* → *relevance*, even more so if that base is more frequent than the derivative (Bermudez-Otero 2012: 32, after Krauza-Szelen 2007: 8.1.2).

**PROBLEM**

No large-scale empirical evaluation of these factors and their interactions has been conducted.

**AIMS**

- Conduct a large-scale investigation of these factors using dictionary data, which may then be used as a reference point for later studies using speech data.
- Two positions are considered: initial pretonic (e.g. *arrive*)
- intonically (e.g. *reduction*)
- Draw some of the theoretical consequences of the results.

**Methodology**

Two datasets have been used:

- **Initial pretonic position:** Data from Jones (2006).
- **Intonational:** Extraction of all words with no stress on their first syllable.

Once proper names have been excluded, the full dataset contains 9432 words.

- **Intonational:** Data from Wells (2008), taken from the datasets of Dabouis (2016). Two datasets were used: morphemic words & bound roots + suffix, and derivational words with a base stressed on its second syllable.

Our study focuses on morphemic words & bound roots + suffix and stress-shifted derivatives for both datasets AND prefixed words for the initial pretonic position.

Only British pronunciations are considered.

- Not included in the analyses:
  - Words with interchangeable vowels: *<- e realized ɪ /e e realized ɪ /e* treated as *Full – Reduced*.
  - Final pretonic: words whose second syllable is part of a historical prefix (e.g. *collect, supercede*).
  - Derivational pairs with a different spelling of the vowel (e.g. *biological – biology*).
  - Neoclassical roots

Vowels followed by *<-o* are treated separately because it is not clear whether they should be analysed as representing underlying *ɪ/ɪ/ or *ɪ/ɪ/.

**THE DATA**

**CODING**

- **SYLLABLE STRUCTURE:** syllables are coded as *Open*, *Closed* or *S* (when the vowel is followed by *<CS*).
- **CODA PLACE:** Coda were coded as *CORONAL* or *NON-CORONAL*.
- **CODA-MANNER:** Coda are coded as *OSTRUMENT* or *SONORANT*.
- **LocFREQUENCY:** token frequency taken from SUBTLEX-UK (van Heuven et al. 2014), which was transformed so as to resemble the way “humans process frequency information” (Hay & Bayes 2002).
- **SPELLING:** vowels were coded as *MONOGRAPH* or *DIGRAPH.*
- **MORPHOLOGY:** presence of a semantically opaque prefix (FINERED vs NONFINERED).
- **SEMANTICTRANSPARENCY:** Items for which the base appears explicitly in the definition in the derivative in a general dictionary (*Dictionary.com*) were coded as *TRANSPARENT.* Others were coded as *OPAQUE.*

The dependent variable is *VOWELREDUCTION,* coded using a four-point scale (Full, Reduced – Reduced, Reduced).

**RESULTS:**

**Monomorphic words and bound roots + suffix (n = 1120 & 454)**

<table>
<thead>
<tr>
<th>Prefixation (n = 2204)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Opaque</strong></td>
</tr>
<tr>
<td><strong>Transparent prefix</strong></td>
</tr>
<tr>
<td><strong>Transposing</strong></td>
</tr>
<tr>
<td><strong>Compositional</strong></td>
</tr>
</tbody>
</table>

- Only the main pronunciation is considered here.

**Results: Prefixed words and stress-shifted derivatives (n = 565 & 179)**

<table>
<thead>
<tr>
<th>Stress-shifted derivatives (n = 565 &amp; 179)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In derived</strong></td>
</tr>
<tr>
<td><strong>In non-derived</strong></td>
</tr>
</tbody>
</table>

- The difference between derived and non-derived is clear in all configurations except in closed initial pretonic syllables, where the vast majority of vowels do not reduce.

Interestingly enough, vowels followed by *<S* behave in a way that is comparable to that of vowels in closed syllables in derivatives, but not in non-derived words.

**Discussion**

The results confirm the importance of position, syllable structure, spelling, morphology and absolute frequency.

However, there is only weak evidence for segmentality factors and the nature of coda consonants.

Other factors may still need to be considered (*Arab Rule* weight interactions, foreigner, vowel-specific behaviours, etc.) to reach a comprehensive understanding of English vowel reduction.

**Monographs followed by *<-C*”**

In non-derived words, the behaviour of vowels followed by *<-C* resembles that of vowels in closed syllables and/or that of digraphs.

In derivatives, there is more reduction in the intonationally than in vowels in closed syllables.

**On preservation effects**

The importance of morphological relationships is found to reduce to reduction, although no effects of segmentality (through relative frequency and semantic transparency) can clearly be confirmed.

**So, what determines vowel reduction in English?**

The results confirm the importance of position, syllable structure, spelling, morphology and absolute frequency.

**On semantically opaque prefixes**

The results confirm the long-standing assumption that there is a distinctive behaviour and supports implications that refusing to see words that contain such morphemes is.

**On monographic prepositional effects**

The importance of morphological relationships is found to reduce to reduction, although no effects of segmentality (through relative frequency and semantic transparency) can clearly be confirmed.

**On preservation effects**

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