

Coarticulation and Representation: /l/-final Rimes in Australian English

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In spoken word recognition, listeners map speech signals to abstract representations using acoustic cues. Canonical cues to phonemes may be impacted by coarticulation. Listeners can compensate for coarticulatory effects when the context is present [1] and rely on coarticulatory cues to identify sound sequences [2, 3]. However, listeners cannot compensate when the motivating context for coarticulatory effects is absent [4], or when coarticulatory effects are phonologized [5]. We can use the knowledge of when listeners do or do not compensate to test if the effect of final /l/ on a preceding vowel is coarticulatory or if it has been phonologized.

Articulatory studies have shown that in English /l/-final rimes the tongue dorsum gesture of the vowel is variably coarticulated with that of /l/ [6, 7]. The coarticulatory effect corresponds to an overall lower F2 of vowels before coda /l/ [8], and to more difficult vowel disambiguation in this context [9]. The close coarticulation between /l/ and its preceding vowel has led to the proposition that /l/-final rimes may have different structural representation from their obstruent-final counterparts. Whereas final obstruents occupy a syllable coda, final /l/, being a complex segment consisting of a vocalic and a consonantal gesture [10], has a closer affinity to the syllable nucleus [e.g. 7]. If the difference between pre-/l/ and pre-obstruent vowels is coarticulatory, resulting from different codas, listeners should be able to compensate for it. If the difference is structural, listeners would compensate in the case of /d/, but not /l/, because /l/-final rimes would contain a phonologized complex nucleus. Therefore, coarticulatory effects would not lower word recognition accuracy, but structural difference between /l/-final and /d/-final rimes would.

To test this hypothesis, 26 native listeners of Australian English (AusE) identified 32 target words from 8 /d/- and 8 /l/-final minimal pairs contrasting /i:-ɪ/ (e.g. *heal/hill*), /ʌ:-ʊ/ (e.g. *fool/full*), /æɔ-æ/ (e.g. *howl/Hal*) and /əʊ-ɔ/ (e.g. *dole/doll*). The vowel pairs were selected because in AusE /l/-final rimes /i:-ɪ/ are retracted, and the members of the other pairs undergo acoustic contrast reduction [11], and are also difficult to disambiguate [9]. Participants identified target words by typing orthographic responses to auditory stimulus.

Accuracy and reaction time (RT) of responses were measured. Linear-mixed effect models with factors Coda and Vowel (interacting), and Word Frequency (not interacting), and random intercept Participant showed that Coda /l/ had no overall effect on accuracy; however, a Vowel x Coda interaction showed that words with /ʌ:, ʊ, æɔ, æ, əʊ/ were identified less accurately before /l/ than /d/ ($p \leq 0.001$, Figure 1). Vowel x Coda interaction on accuracy for /ɔ/ was not significant due to ceiling effects in the Coda /d/ condition. Analysis of errors showed that listeners mostly confused minimal pairs in the /l/ context, whereas different kinds of errors occurred in the /d/ context. Coda /l/ had an overall negative effect on the RT of word recognition ($p = 0.036$). A Vowel x Coda interaction showed that words containing /ɔ, æ/ were identified more slowly before /l/ than /d/ ($p < 0.001$, Figure 2).

Our results partly support the structural hypothesis, as listeners are less accurate in identifying /ʌ:, ʊ, æɔ, æ, əʊ/ in /l/-final rimes, indicating that they do not compensate for the coarticulatory effect of /l/, *despite identifying the word as /l/-final*. Slower RT in the /l/ context might indicate increased processing difficulty for /l/-final words, resulting from the reduced acoustic contrast between the members of the minimal pairs. This is further supported by the finding that listeners tended to make minimal-pair errors in the /l/ context but not in the /d/ context. Effects which may originally have been coarticulatory in the /l/ context have become phonologized. The results also have possible implications for understanding the structure of /d/ final vs /l/ final rimes, suggesting that whereas listeners can break down /d/-final rimes to a nucleus and a coda, /l/-final rimes may involve a different structural realization.

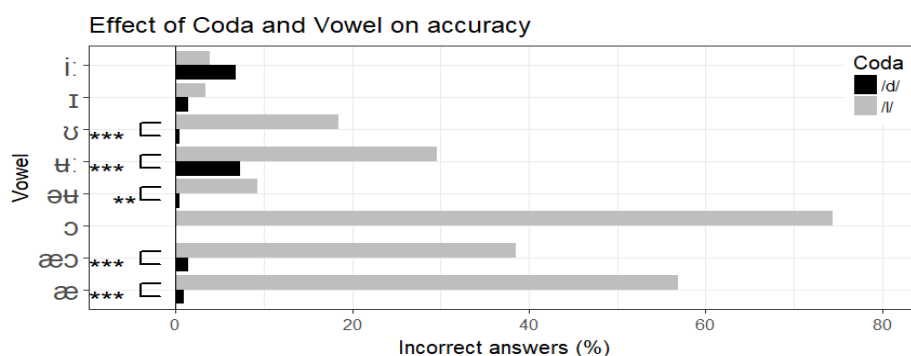


Figure 1. Interactions between Vowel and Coda /l/ on the accuracy of responses.

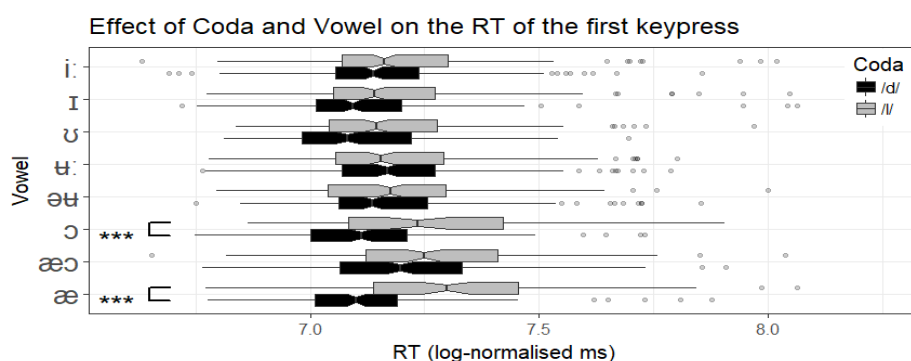


Figure 2. Interactions between Vowel and Coda /l/ on the RT of responses.

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