

## Why do word-final vowels tense? A contrast-based account

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**1. Background.** In many languages with tense-lax contrasts, tense and lax vowels are allowed to contrast in word-final syllables before consonants ( $\_C\#$ ) but not word-finally ( $\_\#$ ), where only tense vowels are permitted. This pattern of contextual neutralisation is found in Dutch (Trommelen, 1983) and Standard French (Tranel, 1987) among other languages.

- (1) a. Dutch  
 $\_C\#$  [a]-[ɑ] [ram] ‘window’ [rɑm] ‘ram’  
 $\_\#$  [a]-\*[ɑ] [mika] ‘mica’ \*[mika]
- b. Standard French  
 $\_C\#$  [o]-[ɔ] [ʁok] ‘hoarse’ [ʁɔk] ‘rock’  
 $\_\#$  [o]-\*[ɔ] [mo] ‘word’ \*[mɔ]

Why do word-final vowels tense in these languages? A common answer is that tensing is directly due to word-final lengthening: word-final vowels are required to be long and lengthening mechanically results in tensing (e.g. Féry 2003 on Standard French). However, the connection between lengthening and tensing is problematic from a phonetic perspective. Indeed, acoustic theory predicts that vowel lengthening should result in less coarticulation with adjacent consonants (e.g. Lindblom 1963) but not necessarily in tensing: as a vowel becomes longer, its first and second formant realisations get more faithful to its formant targets but not necessarily more peripheral. For instance, when lengthened, an underlying /ɔ/ becomes lower and not higher (see Gendrot and Adda-Decker 2005 for evidence in French and German). Therefore, lengthening alone cannot explain why lax /ɔ/ is realised as tense [o] word-finally.

**2. Proposal.** This paper proposes an alternative analysis according to which tensing is an indirect consequence of the loss of duration contrasts word-finally. Word-final positions are well known contexts for the neutralization of duration contrasts (Myers and Hansen, 2007). In languages where tense and lax vowels differ both quality- and duration-wise, word-final neutralization of duration contrasts results in tense-lax pairs differing only quality-wise. If this quality difference is not sufficient to support a phonemic contrast, speakers might be reluctant to maintain the contrast or listeners might fail to identify vowels correctly in this context, resulting in neutralization of tense-lax quality distinctions word-finally. The preference for tense vowels in case of loss of quality distinctions can be explained as an effect of vowel dispersion: tense vowels are more peripheral in the  $F1 \times F2$  space (Stevens, 1998) and therefore should be more distinct from each other than lax vowels. This account differs from the lengthening-based account because what matters here is not word-final lengthening *per se* but its effect on contrast distinctiveness.

**3. Predictions.** *Prediction 1.* The contrast-based account crucially predicts that word-final tensing should be observed only in languages where tense and lax vowels differ both in quality and duration. Languages that are reported to have word-final tensing in the literature happen to have tense-lax pairs differing in both quality and duration, with tense vowels being both more peripheral

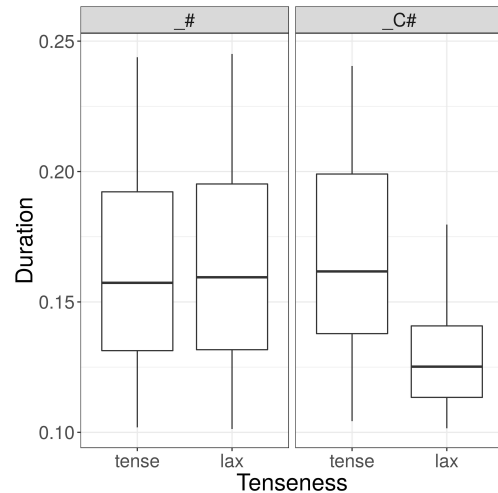


Figure 1: Vowel duration (s) as a function of tenseness and context in Swiss French (front vowels in  $\_\#$ , back vowels in  $\_C\#$ )

and longer than their lax counterparts (e.g. Stevens 1998 on Germanic and Gottfried and Beddor 1988 on [o]-[ɔ] in Standard French).

*Prediction 2.* In a language using duration as a cue for tense-lax contrasts and allowing tense and lax vowels both in *\_C#* and in *\_#*, the difference in duration should be smaller in *\_#* than in *\_C#*. This prediction can be tested in varieties of French that allow some tense-lax contrasts in both contexts, i.e. Parisian French or Swiss French. In these varieties, [o] and [ɔ] contrast in *\_C#* (as shown in (1b)) and [e] and [ɛ] in *\_#* (as shown in (2)).

(2) Standard French tense-lax front vowels contrast word-finally

*\_#* [e]-[ɛ] [vale] ‘valley’ [valɛ] ‘servant’

The contrast-based account predicts that the durational difference between [o] and [ɔ] in *\_C#* should be larger than between [e] and [ɛ] in *\_#*. To test this hypothesis, we used the acoustic data collected in Nyon (11 speakers) and Neuchâtel (13 speakers) in Switzerland by PFC (*Projet de phonologie du français contemporain*; Andreassen 2003; Racine and Andreassen 2012). These data include a list of words read by the 24 Swiss speakers and with occurrences of [e ɛ o ɔ] in the relevant contexts. The acoustic data were aligned automatically. Vowel duration, F1, and F2 were measured (F1 and F2 values were measured at vowel midpoint). Mixed-effects analyses were carried out, with duration, F1, and F2 as dependent variables and tenseness (tense vs. lax), context (*\_#* vs. *\_C#*), and geographic origin as fixed effects (with all interactions). The models also included by-speaker random intercepts and slopes for tenseness, context and their interaction. The results are compatible with the predictions of the contrast-based account. Quality distinctions are maintained both word-finally and before word-final consonants (for [e]-[ɛ] and [o]-[ɔ], respectively) but tense and lax vowels differ in duration only before word-final consonants (for [o]-[ɔ]: word-finally, tense vowels are not significantly longer than lax ones (for [e]-[ɛ]; see Figure 1).

**4. Conclusion.** This paper makes two main contributions: (i) it proposes a phonetically motivated account of word-final tensing and (ii) provides evidence for some key predictions of this account.

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