

## Anticipatory coarticulation in Vowel-Consonant-Vowel sequences in French and in Mandarin

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Coarticulation is traditionally regarded as reflecting both the consequences of biomechanical properties of vocal tract articulators, and those of the strategies underlying the control of speech articulatory gestures. However, using simulations with a 2D biomechanical model of the tongue, Perrier et al. (2004) have observed that physical contributions to the anticipatory coarticulation are negligible (but see also Ostry et al., 1996). Accordingly, anticipatory coarticulation can be regarded as a fair image of high level motor control strategies governing speech articulation, and observing and interpreting the variations of the spatio-temporal characteristics of speech signals associated with changes in the right phonetic context seems to be a fruitful approach to evaluate experimentally models of speech motor control. This is the aim of this study which is carried out in a multilingual, French and Mandarin, context:

The articulatory data were collected using the ElectroMagnetic Midsagittal Articulograph (EMMA AG100, Carstens Electronics) system. Speech material was made up of 15 VCV sequences embedded in meaningful carrier sentences, read by three native speakers of French and three native speakers of Mandarin at a normal speech rate. Acoustic and articulatory data were recorded simultaneously. Corpora were consistent with one another in both languages, V1 and V2 being one of the set /i, a, u/ and C being either the coronal consonant /t/ or the palatal consonant /k/.

In this presentation, only articulatory and acoustic characteristics of V1 and C at targets will be considered. For each sequence V1CV2 and for each subject, the influence of V2 on these V1 and C characteristics was statistically analyzed with an ANOVA (Repeated Measures) carried out on V1 and on C separately. The independent variables were the horizontal and vertical positions of the sensors for V1 and for C, and the independent factor was V2. SPSS™ for Windows was used for this analysis.

Our results suggest that French and Mandarin use different anticipatory strategies. Indeed, French speakers show a significant impact of V2 on V1. The importance of this impact is however depending on V1 and C. Chinese speakers didn't show any significant effect of V2 on V1 neither in /tV/ nor in /kV/ sequence. Both French and Mandarin speakers show a strong influence of V2 on C both for consonant /t/ and /k/.

Therefore, our data suggest for French that the planning of V1CV2 sequences takes into account the whole sequence. This finding is compatible with models of coarticulation like Öhman's model (Öhman, 1967), the MEM model (Abry & Lallouache, 1996) or optimal models of gestural sequence planning such as those proposed by Jordan (1990), Kawato et al (1990), Perkell et al. (2000) or Perrier et al. (2005), which all take into account sequences longer than the syllable. The observed influence of V1 and C on the amount of anticipatory coarticulation suggests also that speech specific phonetic constraints are taken into account in the sequence planning. For Mandarin, the planning of sequences seems to be limited to the syllable CV, which would be in agreement with Kozhevnikov & Chistovitch (1965) hypothesis about the major role of the syllable. Further work using different models of control applied to a biomechanical model of the tongue will aim at testing these different hypotheses.

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