

## **Invariance in articulatory movements: a C/D model approach**

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The purpose of the study is to discover an effective method of characterizing movement patterns of the crucial articulator as the function of an abstract syllable magnitude and the adjacent boundary, and at the same time to investigate effects of prosodic control on utterance organization. In particular, the speed of movement when a flesh-point on the tongue blade or the lower lip crosses a selected position relative to the occlusion plane is examined. The time of such crossing provides an effective measure of syllable timing and syllable duration according to previous work. In the present work, using a very limited vocabulary with only a few consonants and one vowel as the key speech materials, effects of contrastive emphasis on demisyllabic movement patterns were studied. The theoretical framework for this analysis is the C/D model of speech production in relation to the concept of an invariant part of selected articulatory movements. The results show evidence in favor of the existence of 'iceberg' patterns, but a linear dependence of slope on the total excursion of the demisyllabic movement, instead of the approximate constancy of the threshold crossing speed as suggested in the original proposal of the 'iceberg', has been found. Accordingly, a revision of the original concept of 'iceberg' seems necessary. This refinement is consistent with the C/D model assumption on 'prominence control' that the syllable magnitude determines the movement amplitude, accompanying directly related syllable duration change. In this assumption, the movement of a consonantal component should also be proportional to syllable magnitude. The results suggest, however, systematic outliers deviating from the linear dependence of movement speed on excursion. This deviation may be caused by the effect of the immediately following boundary, often referred to as phrase-final elongation.