The effect of sentence level accent on the V-to-V coarticulation induced variability of vowels

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In general communicative situations, speech sounds do not occur in isolation, but rather in succession, forming a continuous speech stream. As we know, however, in this stream, the movement of the articulators, or more precisely, the movement responses from contiguous phoneme commands overlap in time, and interact with one another [1]. This process, i.e., coarticulation is one of the main reasons of the articulatory and acoustic variability of speech segments commonly observed in the phonetic analysis of speech, as opposed to the uniform representation of these segments stipulated in many phonological frameworks. The origin, function, and control of this process are a matter of continuous interest and debate, including the question if coarticulation is mainly a result of biomechanical properties of the articulatory organs (see [12]), or if it is part of the (phonetic) grammar controlled by phonologized rules (see [3]).

Irrespective of the theoretical accounts invoked to explain the phenomenon, we find a growing body of evidence revealing an interplay of prosodic prominence and coarticulation. Among others, these studies lead us to conclude that if the CV syllable is stressed, the V exhibits a decreased susceptibility to the C-induced coarticulation, and if the syllable is unstressed, there is a decreased resistance to it (see e.g., [4][5]). In addition, we also come across results supporting the claim that segments in CV clusters which exhibit greater coarticulatory resistance also display greater coarticulatory aggressiveness, that is, they exert a greater coarticulatory impact on the adjacent segment (see e.g., [6]). Following the above line of reasoning, the question arises, if the strengthening effect of prosodic prominence also induces coarticulatory aggressiveness just as it induces coarticulatory resistance. Moreover, we can also raise the question, if these effects are present also in coarticulation among non-adjacent segments, such as e.g., V-to-V coarticulation in VCV sequences. To the combination of these questions, [7] provided a negative answer through the analysis of 4 English speakers' V#/b/V sequences on which syllables the position of sentence level accent was varied. This study, however, covered only the articulatory domain. As for the acoustic domain, [8] tested if Cs exhibiting a higher degree of dorsal activity (/ɲ/, and dark /l/) allow for more V-to-V carryover coarticulation in nonsense VCV sequences than those of lower dorsal activity (/ð/ and clear /l/) in Catalan, if V_1 and V_2 vary in the presence or absence of lexical stress. Through the analysis of 5 speakers' data [8] concluded that (1) the effect of V-to-V coarticulation is stronger if the C is constrained less, (2) the reduction of the V is stronger if it unstressed, and (3) Vs have a greater coarticulatory aggressiveness if they are stressed. (Note that the effect of lexical stress and sentence level accent varied in these two studies.) However, [8] also pointed out that future work should clarify if these effects hold also in more speakers, in real words, and for other languages.

In an attempt (1) to further explore if prominence provokes coarticulatory resistance in V-to-V coarticulation, and (2) to uncover the language-specificity of the effect of prominence, in the present study we will analyze V-to-V carryover coarticulatory effects in real words containing /u/ and /i/, in minimally constrained C-context, and in the presence and absence of sentence

level accent in Hungarian (where lexical stress is fixed to the first syllable). In line with previous research, we hypothesize that Vs in accented syllables are more resistant to coarticulation, and that /i/ is more resistant than /u/ (see [6] for CV coarticulation).

Acoustic recordings were made of 19 adult Hungarian speakers producing the sequences /uhu/, /ihu/, /ihi/, and /uhi/ (in meaningful sentences) in two accent conditions, /'VCV/ and /V#'CV/, where sentence level accent fall either on V_1 (i.e., the V which induced coarticulation in the asymmetrical context) or on V_2 (on which V the effect of coarticulation was measured) (the corpus was originally recorded in [9]). In order to maximize coarticulatory effects, the C was the glottal fricative /h/, which is known to be underspecified for oral configuration, and thus interferes the least with the single underlying diphtongual gesture (see [10]) of the V segments.

We plan to measure F_2 values of the target V_2 in the V onset and the midpoint of the V steady-state, and F_1 in the latter measurement point. Following the methods of Bang (2017) and the traditional locus equation approach for operationalizing the degree of coarticulation, we plan to build a linear mixed model using F_{2onset} as the outcome variable, and F_{2mid}, context (symmetrical/asymmetrical), vowel quality, and accent (accent/no accent) as fixed factors, and we add random slopes and intercepts for speakers. Additionally, we also plan to assess the magnitude of vowel dispersion via the calculation of the Euclidean distances of V_2 data points based on $F_{1mid} \times F_{2mid}$ values.

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