Does VtoV coarticulation always require "look-ahead"? Evidence from an EMA and acoustic study of Campanian Italian

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One of the most pervasive phenomena in speech is coarticulation: the fact that neighboring sounds influence one another. Two main models for coarticulation have been proposed: coproduction and look-ahead ([1], [2], [3]). Coproduction models hold that coarticulation is strictly rooted in local overlap and blending of articulatory gestures ([1]). Look-ahead models hold that coarticulation can be long-distance, with non-neighboring segments influencing each other ([3], [4]). A coarticulatory phenomenon that has attracted much attention to test the predictions of these two models is anticipatory trans-consonantal Vowel-to-Vowel (VtoV) coarticulation ([1],[4],[5],[6]). VtoV coarticulation can also be phonologized into metaphonic effects, which are, for instance, largely attested in Italo-Romance varieties ([8], [9]). These are particularly of interest because they suggest that, at least at diachronic timescales, VtoV coarticulation can lead to long-distance sound changes. The question we examine is whether synchronic coarticulation already betrays the hallmarks of these long-distance phenomena in an acoustic and electromagnetic articulography (EMA) study of VtoV coarticulation in Campanian Italian. Methods. Participants. We collected data from 10 Campanian Italian speakers (6M, 4F, with a target of 15 for the conference). Beyond Italian, they all have knowledge of their local dialect. We focused on Italian produced by Campanian speakers because their native dialect displays phonologized metaphony ([10]). Given the lack of experimental work on VtoV effects in Italian, we considered Campanian speakers a good testing ground. *Items.* We elicited disyllabic words of the structure $^{\prime}CV_{1}C(:)V_{2}$, in which V was either /a, e, i, o/, while C was either bilabial, labiodental, alveolar, or nasal, and either singleton or geminate. We excluded velars because they can be allophonically palatalized before front vowels ([11]). The total of tokens collected was: 374 words x 10 speakers = 3740. Procedure. Target items were produced in a carrier sentence. We collected simultaneous EMA and audio data using a three-dimensional Carstens AG501 system sampling at 1250 Hz. 10 sensors were used to track tongue, lips, and jaw movement. Since we focused on vowel production, we analyzed the vertical and horizontal dimensions of the tongue dorsum sensor $(TD_y and TD_x)$ which reflect vowel height and frontness respectively. For the acoustic signals, we conducted formant analyses as coarse correlates of vowel height (F1) and frontness (F2). Analyses. Separately by stem vowel, we conducted mixed effect regression analyses at different time points of the stem vowel (V_1) to check when a significant effect as a function of the suffix vowel (V_2) is observed. Additionally, we also tested whether different consonant types affect the degree of VtoV coarticulation. Results. Our statistical analyses show that, at around 75-80% of V_1 , V_2 starts exerting an influence on both TD_y and TD_x , indicating an anticipatory coarticulatory effect that is present in the last quarter of V₁. This pattern is robust for /a,e,o/ and weaker for /i/. We illustrate our findings with $V_1 = /a/$ in Figure 1A and B. In line with the EMA data, effects on acoustic formants, especially F2, are also limited to the final portion of the vowel. Finally, for most vowels, certain transvocalic consonants, specifically geminates, attenuate VtoV effects on the TD_x and TD_y position, Figure 1C. Conclusion. To sum up, our findings indicate that, in terms of temporal extent, VtoV effects are limited to the last quarter of V_1 and get stronger the closer to V_2 . Thus, VtoV coarticulation is local more than long-distance. Second, our findings also suggest that VtoV coarticulation is modulated by intervening consonants. Combined together, these two findings support the notion that in Campanian Italian VtoV effects are in agreement with the predictions of a coproduction model supplemented with a weak anticipatory gestural field ([1]) more than with those of look-ahead models. If this is correct, sound changes like metaphony, albeit originating in VtoV effects, need not to be the direct result of look-ahead coarticulation. Rather, local coarticulation, in the course of phonologization, needs to be magnified by additional mechanisms, such as e.g., perceptual reparsing, temporal realignment of gestural activation windows ([12]).



Figure 1. A): Tongue Dorsum Height, and B): Tongue Dorsum Frontness at 50%, 75% ... 99% for $V_1 = /a/$, as a function of different suffix vowels (V₂). The y-axis represents in A) TD_y and in B) TD_x (z-scored) for each vowel, and the x-axis different V₂ contexts, e.g., a_a, a_e, a_i etc. Notice how, progressing across panels from 50% to 100% of V₁ duration, TD_y becomes higher (i.e. more raising) and TD_x lower (i.e. more fronted) in the a_i context, while TD_y becomes lower and TD_x higher in the a_a context, thus anticipating the position for V₂. C): Same plot as A) but with V₁ = /e/ and intervening consonants being only geminates. Notice how VtoV effects are absent for the /e/ vowel even at 99% of V₁ when the intervening consonants are geminates.

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